

AP Statistics AP Exam Review Homework #3

Question 1 is a regular AP question---12 minutes to complete while #2 is a #6 –type question ---25 minutes to complete)

1. There have been many studies recently concerning coffee drinking and cholesterol level. While it is known that several coffee-bean components can elevate blood cholesterol level, it is thought that a new type of paper coffee filter may reduce the presence of some of these components.

The effect of the new filter on cholesterol level will be studied over a 10-week period using 300 nonsmokers who each drink 4 cups of caffeinated coffee per day. Each of these 300 participants will be assigned to one of two groups: the experimental group, who will only drink coffee that has been made with the new filter, or the control group, who will only drink coffee that has been made with the standard filter. Each participant's cholesterol level will be measured at the beginning and at the end of the study.

- Describe an appropriate method for assigning the subjects to the two groups so that each group will have an equal number of subjects.
- In this study, the researchers chose to include a group who only drank coffee that was made with the standard filter. Why is it important to include a control group in this study even though cholesterol levels will be measured at the beginning and at the end of the study?
- Which test would you conduct to determine whether the change in cholesterol level would be greater if people used the new filter rather than using the standard filter?
- Why would the researchers choose to use only nonsmokers in the study?

2. A study was designed to explore subjects' ability to judge the distance between two objects placed in a dimly lit room. The researcher suspected that the subjects would generally overestimate the distance between the objects in the room and that this overestimation would increase the farther apart the objects were.

The two objects were placed at random locations in the room before a subject estimated the distance (in feet) between these two objects. After each subject estimated the distance, the location of the objects were rerandomized before the next subject viewed the room.

After data were collected for 40 subjects, two linear models were fit in an attempt to describe the relationship between the subjects' perceived distances (y) and the actual distance, in feet, between the two objects.

$$\text{Model 1: } \hat{y} = 0.238 + 1.080x \text{ (actual distance)}$$

The standard errors of the estimated coefficients for Model 1 are 0.26- and 0.118, respectively.

$$\text{Model 2: } \hat{y} = 1.102x \text{ (actual distance)}$$

The standard error of the estimated coefficient for Model 2 is 0.393.

- Provide an interpretation in context for the estimated slope in Model 1.
- Explain why the researcher might prefer Model 2 to Model 1 in this context.
- Using Model 2, test the researcher's hypothesis that in dim light participants overestimate the distance, with the overestimate increasing as the actual distance increases. (Assume appropriate conditions for inference are met.)

The researchers also wanted to explore whether the performance on this task differed between subjects who wear contact lenses and subjects who do not wear contact lenses. A new variable was created to indicate whether or not a subject wears contact lenses. The data for this variable were coded numerically (1 = contact wearer, 0 = noncontact wearer), and this new variable, named "contact," was included in the following model.

$$\text{Model 3: } \hat{y} = 1.05x \text{ (actual distance)} + 0.12x \text{ (contact)} \times \text{(actual distance)}$$

The standard errors of the estimated coefficients for model 3 are 0.357 and 0.032, respectively

(d) Using Model 3, sketch the estimated regression model for the contact wearers and the estimated regression model for the noncontact wearers on the grid below.

- In the context of this study, provide an interpretation of the estimated coefficients for Model 3.