AP® Statistics
1999 Scoring Commentary

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Question 1

This question required the student to interpret a residual plot, read generic computer regression output, and interpret the slope and intercept of the least squares regression line in context. To receive full credit for this problem, a student needed to make it clear that he or she understood the difference between the model and the data in the interpretation of the slope and intercept. In some cases, it was difficult to distinguish between this and the language that students used when rounding. Some students who showed a good understanding of regression models in some parts of the problem were unable to read the generic computer output. Although the AP Statistics Course Description makes it clear that students are expected to be familiar with computer output, it appeared that not all teachers are including this in the course.

Common errors in answering question 1 were:

- Mistaking the residual plot for a scatter plot of the data. Many students entered the values from the plot into their calculators to find a slope and intercept.
- Failure to distinguish between the least squares line and the actual data. The estimated slope was not interpreted as an estimate of average rate of increase in number of aircraft. The intercept was interpreted as the actual number of aircraft in 1990 instead of as a predicted number of aircraft.
- Students could not find the values of the estimated slope and intercept in the generic computer output.

Question 2

This question required the student to analyze data in a two-way table. The most common approach was to use a Chi-square test for independence. Communication continues to be a problem in questions requiring data analysis, and many students had difficulty explaining the approach taken and clearly communicating the results of the analysis. Although more students mentioned assumptions required in order for the analysis to be valid, few actually checked to see that the assumptions were met. The Chi-square test is a topic that is often covered late in the course, and judging from the large number of zeroes given and blank responses on this question, it appears that many classes may not have covered this topic.

Common errors in answering question 2 were:

- Incorrectly stating the hypotheses for the test.
- Approaching the problem by testing all possible pairs of proportions.
- Poor communication of conclusions, especially in linking the conclusion to the results of the statistical test (i.e., the P-value).
- Failure to mention assumptions, or stating assumptions without checking to see if they are met.

Failure to use any inferential procedure, reaching a conclusion by just "looking at the data."

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Question 3

This question tested a student's knowledge of the difference between an observational study and an experiment, and also of the concept of confounding. This was one of the two highest-scoring questions on the exam, and there were very few blank or off-task papers. Most students were able to recognize that the study described in the question was not an experiment, but many had difficulty with the explanation. The concept of confounding was problematic for many students.

Common errors in answering question 3 were:

- In part (a), many students stated that there were no treatments. They did not comment on the need for random assignment of subjects to treatments. Many confused the idea of "controlled experiment" with the need for a control group.
- In part (b), students confused the idea of a confounding variable with any variable that might have an effect on the response variable. They often did not recognize that a confounding variable had to be something that was related to group membership. Students also confused confounding variables and lurking variables.
- In part (b), students often thought that natural variation from subject to subject would invalidate the study.
- In part (c), students often gave a nice example of a confounding variable and how it would prevent drawing a cause-and-effect conclusion without realizing they were describing a confounding variable (having answered part b incorrectly or having left it blank).

Question 4

This question tested the student's ability to apply basic probability concepts in a practical setting. Part (a) required a simple computation of a probability from a standard normal distribution, and part (b) required application of basic probability rules. Students had more difficulty with part (c), which required them to find the quartiles of a normal distribution.

Common errors in answering question 4 were:

- Computation of a two-tailed probability instead of a one-tailed probability in part (a).
- Misuse of memorized rules (such as the Empirical Rule). Many students incorrectly stated that 97% of the distribution was within two standard deviations or used other incorrect percentages.
- Correctly using a binomial or geometric probability distribution to compute probabilities in part (b), but then not adding over the correct set of possible values.

In part (c), inability to evaluate the quartiles of a normal distribution, and/or subtraction of 1.5(IQR) from 0 rather than the lower quartile.

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Question 5

Students generally did well on this question, which required them to analyze a simple game of chance. To answer part (a), students had to calculate the probability of winning the game for each of two choices, and determine which choice would be most advantageous. In part (b), the probabilities from part (a) were used to determine the prize required for a fair game.

Common errors in answering question 5 were:

- Computing an expected value for the roll of each die in part (a) and then basing a decision on these expected values rather than on the probability of winning for each die.
- Not recognizing that the outcomes of the two dice needed to be compared, and so conducting two separate analyses.

Question 6

This question was a great problem conceptually, but the context seemed to confuse many students. Many students had trouble distinguishing between the actual outcomes of the coin tosses and the sequence of guesses. Part (a) required analysis of just the after training scores, part (b) required an assessment of before/after change, and part (c) required an assessment of association.

Common errors in answering question 6 were:

- Failure to read part (a) carefully. Many students compared the before and after scores in part (a) instead of focusing just on the after training scores.
- In the hypothesis tests of parts (a) and (b), many students failed to state and check assumptions. Few of those that stated assumptions gave any indication that they actually checked to see if the assumptions were reasonable.
- Poor communication of conclusions and/or conclusions not based on any inferential procedure.
- Failure to recognize that the association/prediction question in part (c) required additional work and could not be answered based on the results of parts (a) and (b).