AP® Statistics
2003 Scoring Commentary
Form B

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AP® STATISTICS
2003 SCORING COMMENTARY (Form B)

Question 1

Sample A – Score 4

The student referred to the change in the correlation coefficient and the change in the regression equations. The response in part (b) discussed the change in the slope and intercept, and the final sentence made the comparison with the previous relationship clear.

Sample B – Score 3

The student discussed the change in the regression equation in part (a). No other measures of the influence are given but the student did provide a discussion of the point's extreme value in the x direction and how that is related to the point's potential for influence (though it was not completely clear what was meant by "a more precise regression line"). This discussion is continued in part (b). The student indicated that the line will change but only said "closer to the x-axis" and did not seem to realize that the slope will be negative.

Question 2

Sample A – Score 4

The student used correct notation and clearly showed the numbers involved in the calculations. In part (c), the student stated the problem in terms of set notation and then, using the calculations already completed in parts (a) and (b), stated that the events are not independent for those in this sample.

Sample B – Score 3

This solution was very clearly communicated. The probabilities in parts (a) and (b) were correctly calculated. However in part (c), the student did not appeal to his or her work in parts (a) and (b) and instead performed a different calculation, therefore not receiving full credit for part (c).

AP® STATISTICS
2003 SCORING COMMENTARY (Form B)

Question 3

Sample A – Score 4

In part (a), the student referred to the deliberate manipulation and imposition of treatment, as well as random assignment. In part (b), the student correctly stated the one-sided hypotheses and indicated in the discussion how the two groups are defined. The student also defined "success" which was needed to know that the direction of the alternative hypothesis was correct. The procedure name "*p*-test" does not clearly correspond to any test on the AP syllabus. But since the discussion made it apparent that the student was comparing two proportions, and based on the strength of the response in part (a), this paper received a score of 4.

Sample B – Score 3

In part (a) the student indicated a treatment group and a control group. It is not clear from the beginning of the response that the treatments were imposed on these subjects randomly. However, it was felt that the subsequent discussion ("participants did not know what they really received") indicated the student did understand this idea. In part (b) the student gave the common response of a Chi-square procedure which is not appropriate because the alternative hypothesis is one-sided. The student received full credit for the hypothesis statements but not for the identification of the test procedure.

Question 4

Sample A – Score 4

In part (a) the student assigned numbers to the participants and then randomly selected 150. In part (b), the student identified that another factor could change during the course of the experiment but that a control group would also be affected by these factors allowing us to isolate the effects of the new filter. In part (c), the student correctly identified a two-sample *t*-test, clarifying that this will compare the two mean cholesterol changes. In part (d) the student identified reduction of variability as the main advantage of using the more homogeneous group.

Sample B – Score 3

In part (a) the student numbered the subjects, clearly indicated how the random number table will be used, and ensured that 150 subjects were in each group. In part (b), the student identified a reasonable potential confounding variable (psychological effects) during the course of the study as the reason for using a control group. In part (c), a two-sample *t*-test was identified. The student clarified that this test will compare means through the hypothesis statements. In part (d), the student discussed how smoking could be confounded with the explanatory variable, which is incorrect. In particular, if both smokers and nonsmokers were included in the study, randomization should distribute them equally between the new filter and the old filter groups, preventing a confounding effect. Thus the issue here is variability, not confounding.

AP® STATISTICS
2003 SCORING COMMENTARY (Form B)

Question 5

Sample A – Score 4

In part (a), the student performed the correct calculation and in part (b), the student found the correct outcomes and then averaged them. It could be clearer that this is an expected value calculation. In part (c), the student stated the correct hypotheses for a goodness of fit test (not only that the four probabilities are equal but also that they must equal 0.25) and gave excellent definitions of the parameters. The student stated that the expected values must be at least 5 and clearly calculated the expected counts to check this condition. The test statistic calculations are correct, though no work is shown, and the student has specified the rejection region. The conclusion compares the test statistic to the rejection region, comes to a correct decision, and is stated in context.

Sample B – Score 3

In part (a), the student calculated the correct probability in a detailed manner with interpretation. The calculation of the expected value in part (b) is not correct since the student has calculated the expected outcome for an individual spin and has not taken into account the current $800 in earnings. In part (c), the hypotheses are slightly misstated (since the student did not refer to the probabilities of the outcomes) and the check of conditions is incomplete. However, the test statistic and *p*-value are correct and a conclusion is presented in context. Based on the strength of the discussion and interpretation, this response received a score of 3.

Question 6

Sample A – Score 4

The student provided a check of the conditions and carried through the correct mechanics to calculate the confidence interval. The interpretation of the confidence interval and confidence level are both correct and given in context. The student may not have been completely consistent in the use of notation, but this did not detract from the overall strength of the discussion. In part (b), the student discussed the link between the length of the interval and the margin of error, indicating that the 2,000 subjects should be equally divided into 8 groups. In part (c), the student continued this discussion and examined how each $p(1-p)$ piece contributes to the overall sum, solving for the correct sample sizes to equalize the margins of error.

Sample B – Score 3

The student correctly calculated the confidence interval but did not check any of the conditions. The interpretation of the confidence interval is weak and made no appeal to the confidence level, but is in context. The interpretation of the confidence level is correct but is stated in terms of a generic μ instead of in terms of proportions. In part (b), the student recognized the need for equal sample sizes. In part (c), the student solved for the sample sizes to obtain the same margin of error as in part (b) and scaled up the sample sizes.