

## 2001 AP<sup>®</sup> STATISTICS FREE-RESPONSE QUESTIONS

2. A department supervisor is considering purchasing one of two comparable photocopy machines, *A* or *B*. Machine *A* costs \$10,000 and machine *B* costs \$10,500. This department replaces photocopy machines every three years. The repair contract for machine *A* costs \$50 per month and covers an unlimited number of repairs. The repair contract for machine *B* costs \$200 per repair. Based on past performance, the distribution of the number of repairs needed over any one-year period for machine *B* is shown below.

Number of Repairs	0	1	2	3
Probability	0.50	0.25	0.15	0.10

You are asked to give a recommendation based on overall cost as to which machine, *A* or *B*, along with its repair contract, should be purchased. What would your recommendation be? Give a statistical justification to support your recommendation.

3. Every Monday a local radio station gives coupons away to 50 people who correctly answer a question about a news fact from the previous day's newspaper. The coupons given away are numbered from 1 to 50, with the first person receiving coupon 1, the second person receiving coupon 2, and so on, until all 50 coupons are given away. On the following Saturday, the radio station randomly draws numbers from 1 to 50 and awards cash prizes to the holders of the coupons with these numbers. Numbers continue to be drawn without replacement until the total amount awarded first equals or exceeds \$300. If selected, coupons 1 through 5 each have a cash value of \$200, coupons 6 through 20 each have a cash value of \$100, and coupons 21 through 50 each have a cash value of \$50.
- (a) Explain how you would conduct a simulation using the random number table provided below to estimate the distribution of the number of prize winners each week.
- (b) Perform your simulation 3 times. (That is, run 3 trials of your simulation.) Start at the leftmost digit in the first row of the table and move across. Make your procedure clear so that someone can follow what you did. You must do this by marking directly on or above the table. Report the number of winners in each of your 3 trials.

72749 13347 65030 26128 49067 02904 49953 74674 94617 13317

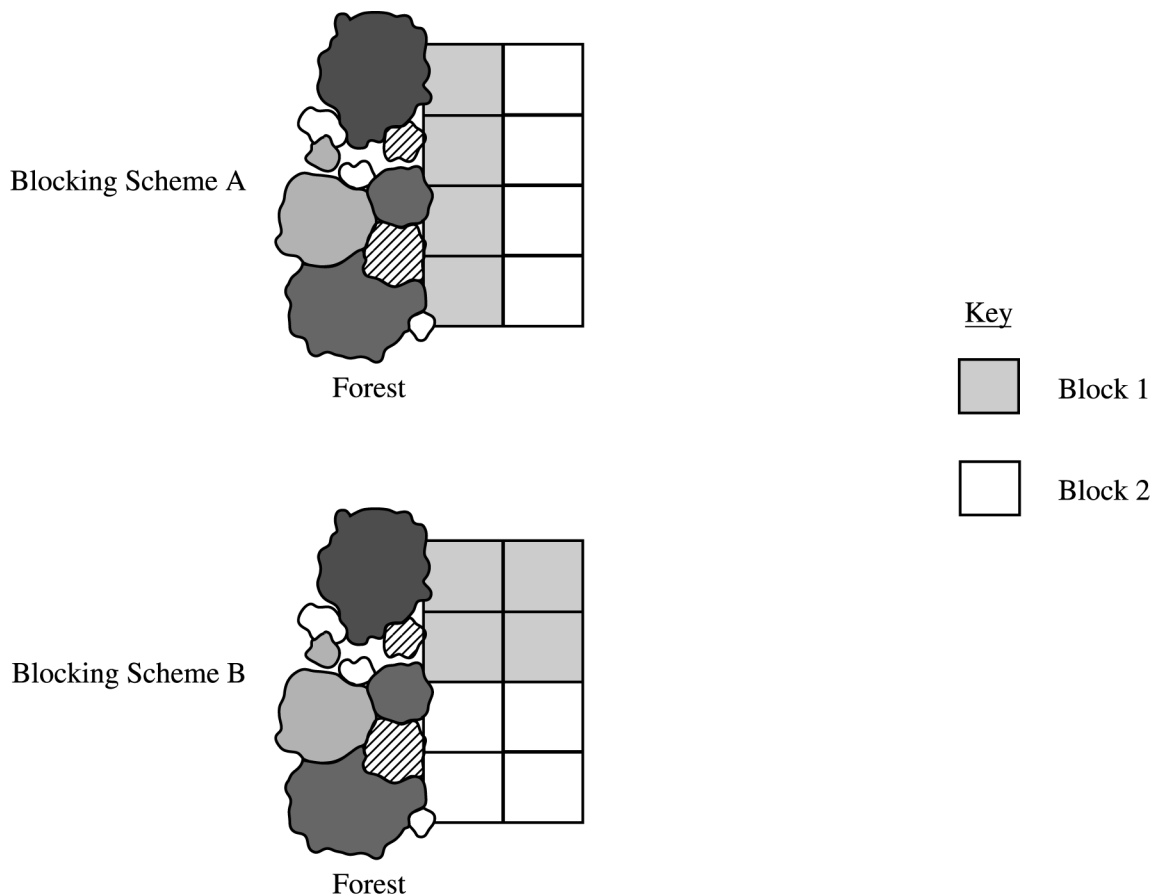
81638 36566 42709 33717 59943 12027 46547 61303 46699 76423

38449 46438 91579 01907 72146 05764 22400 94490 49833 09258

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4. Students are designing an experiment to compare the productivity of two varieties of dwarf fruit trees. The site for the experiment is a field that is bordered by a densely forested area on the west (left) side. The field has been divided into eight plots of approximately the same area. The students have decided that the test plots should be blocked. Four trees, two of each of the two varieties, will be assigned at random to the four plots within each block, with one tree planted in each plot.

The two blocking schemes shown below are under consideration. For each scheme, one block is indicated by the white region and the other block is indicated by the gray region in the figures.



- (a) Which of the blocking schemes, A or B, is better for this experiment? Explain your answer.
- (b) Even though the students have decided to block, they must randomly assign the varieties of trees to the plots within each block. What is the purpose of this randomization in the context of this experiment?

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2001 SOLUTIONS AND SCORING GUIDELINES

Question 3 (cont'd.)

4. **Non-Replacement:** must state that coupon numbers chosen cannot be used more than once in the same trial.
5. **Execution of #1 and #2:** must demonstrate a correct execution of a scheme with a stopping rule.
- Credit for components #1 and #2, is given for statements in part (a).
  - Credit for component #3 and/or #4 may be given for statements or demonstrations in parts (a) or (b).
  - Credit for component #5 is given for a clear demonstration in part (b).

**Scoring Guide:**

- 4 Complete Response**  
Essentially correct on all five components.
- 3 Substantial Response**  
Essentially correct on four of the five of components.
- 2 Developing Response**  
Essentially correct on three of five components.
- 1 Minimal Response**  
Essentially correct on component #5 only  
or  
Essentially correct on any two of the other components.

One **INCORRECT** solution is to use the random digit 1 to represent a \$200 prize, random digits 2, 3, and 4 to represent a \$100 prize, and random digits 6, 7, 8, 9, and 0 to represent a \$50 prize.

Then a trial might look like

number	amount	total so far
7	50	50
2	100	150
7	50	200
4	100	300

A student using this scheme can merit **at most a score of 2** for the entire problem.