

**AP[®] STATISTICS
2004 SCORING GUIDELINES**

Question 2

Solution

Part (a):

Block	Volunteers	Ages
1	1, 2	20, 21
2	10, 11	23, 24
3	8, 9	44, 44
4	3, 12	46, 47
5	4, 7	58, 60
6	5, 6	61, 62

Since these researchers believe that the condition of hair changes with age but not gender, the volunteers are sorted from youngest to oldest. The volunteers in the sorted list are paired to form six blocks of size two. More specifically, the youngest two volunteers are placed in the first block. The next two volunteers in the sorted list are placed in the second block. This pairing continues until all six blocks of two are formed, with the oldest two volunteers in the sixth block.

Part (b):

Block	Volunteers	Ages
Female 1	2, 10	20, 24
Female 2	8, 12	44, 46
Female 3	4, 5	60, 62
Male 1	1, 11	21, 23
Male 2	3, 9	47, 44
Male 3	6, 7	61, 58

Since these researchers believe that the condition of hair changes with both age and gender, the women are sorted from youngest to oldest and then the men are sorted from youngest to oldest. The women (men) in the sorted list are paired to form the blocks of size two. More specifically, the youngest two women (men) are placed in a block. The next two youngest women (men) are placed in another block. Finally, the oldest two women (men) are placed in another block.

Part (c):

No, the researchers in part (b) should not randomly select three blocks to receive the new formula and then give the current formula to the other three blocks. They blocked on both age and gender to form homogeneous groups because they believe hair condition differs with both age and gender. Giving the youngest or oldest women (men) the same formula defeats the purpose of blocking. In a block design, randomization should be carried out separately within each block. That is, for each block, two random numbers are generated (via a random number generator or a table of random digits) and assigned to the two volunteers. The volunteer with the smallest random number is given the new formula and the other volunteer is given the current formula.

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Question 2 (cont'd.)

Scoring

Each part is scored as essentially correct, partially correct, or incorrect.

Parts (a) and (b) are each scored as essentially correct if

1. the six blocks are correctly identified by volunteer number or age AND
2. the correct criterion for assigning volunteers to blocks is clearly stated.

Parts (a) and (b) are scored as partially correct if either component 1 or 2 above is correct.

- Notes:
1. If at most two volunteers are misplaced, but it is clear that the student is blocking correctly, component 1 can be considered to be correct.
 2. Simply saying “block by age” or “block by age and gender” is not sufficient to get credit for component 2. A student must indicate that the volunteers in each block are similar with respect to age in part (a) or age and gender in part (b). However, if the student has correct blocks but only says to “block by age” in part (a) and “block by age and gender” in part (b), this should only be penalized once.
 3. In part (a), if a student blocks correctly by age, each block happens to contain one male and one female. If the student says or implies that this is an important part of the blocking criterion, then component 2 is incorrect. If they simply comment or notice this fact but do not imply or say that it is part of the criterion, component 2 could be correct.

Part (c) is essentially correct if the student recognizes that this is not an appropriate way to assign treatments AND describes an appropriate method for assigning treatments within each block, including a method of randomization that can be implemented by the reader.

Note: Simply saying “use a random number table” or “flip a coin” is not sufficient to get credit for the method of randomization

Part (c) is partially correct if the student recognizes that this is not an appropriate way to assign treatments AND either

1. assigns treatments randomly within blocks but lacks a method of randomization, OR
2. assigns treatments within each block with no mention of randomization, OR
3. gives a correct reason why the assignment is not appropriate.

Part (c) is incorrect if

1. the student says that this is an appropriate way to assign treatments, OR
2. “NO” is the only response, OR
3. “NO” is the response, but the reason is wrong or absent AND either
 - i) no indication is given about assigning treatments within blocks OR
 - ii) an alternative design is proposed (e.g., crossover, completely randomized).

Note: If in part (b) the student makes heterogeneous blocks (i.e., blocks contain one male and one female of disparate ages), then saying “YES” with an appropriate method of randomization is essentially correct for part (c). In the same situation, if the student says to assign treatments to the blocks with no randomization method, this is scored partially correct for part (c).

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Question 2 (cont'd.)

4 Complete Response

All three parts essentially correct

3 Substantial Response

Two parts essentially correct and 1 part partially correct

2 Developing Response

2 parts essentially correct and no parts partially correct

OR

One part essentially correct and 2 parts partially correct

OR

3 parts partially correct

OR

One part essentially correct and 1 part partially correct

1 Minimal Response

One part essentially correct and 1 part partially correct

OR

One part essentially correct and 0 parts partially correct

OR

No parts essentially correct and 2 parts partially correct

Note: One part essentially correct and one part partially correct may be given a score of either 1 or 2 holistically.