

Name: Key

## STATISTICS

### PART 3 PRACTICE EXAM 1

Time – 1 hour and 30 minutes

Number of multiple choice questions – 20

Number of free response questions - 3

1. The maker of a popular pain reliever conducted an experiment to see if there were benefits from adding calcium to their formula. Five hundred people who experienced regular headaches took part in the experiment. Two groups were randomly formed; one group took the pain reliever with the added calcium while the other group took the original formulations. The people in the group that took the new formula with calcium reported a shorter average waiting time for pain relief than the people with the original formulation. Which of the following is (are) true concerning the results of this experiment?

- I. We cannot conclude a cause-effect relationship between the presence of calcium and waiting time for pain relief.
- II. The addition of calcium to pain relievers may reduce time to experience pain relief.
- III. There were not enough subjects in the experiment to draw a conclusion.

- (A) I only
- ☒ (B) II only
- (C) III only
- (D) I and II only
- (E) I and III only.

2. The only way to ensure a cause-effect relationship between two variables is to

- (A) conduct an observational study
- (B) conduct a census
- (C) conduct a study with volunteers
- (D) conduct a survey
- ☒ (E) conduct an experiment

3. It is thought that 40% of all students that take Physics also take Chemistry at some point in their high school careers. A simulation is designed to estimate the probability that 10 randomly selected students who take Physics will take Chemistry. The digits 0 through 9 will be used for the simulation. Which of the following assignments of digits would best model this simulation?

- (A) Assign "1, 2, 3, and 4" as taking Chemistry and "5, 6, 7, 8, and 9" as not taking Chemistry.
- (B) Assign "0, 1, 2, 3, and 4" as taking Chemistry and "5, 6, 7, 8, and 9" as not taking Chemistry.
- ☒ (C) Assign "0, 1, 2, and 3" as taking Chemistry and "4, 5, 6, 7, 8, and 9" as not taking Chemistry.
- (D) Assign "4" as taking Chemistry and "1, 2, and 3" as not taking Chemistry.
- (E) Assign "4" as taking Chemistry and "0, 1, 2, 3, 5, 6, 7, 8, and 9" as not taking Chemistry.

4.

A school committee member is lobbying for an increase in the gasoline tax to support the county school system. The local newspaper conducted a survey of county residents to assess their support for such an increase. What is the population of interest here?

- (A) All school-aged children
- ☒ (B) All county residents
- (C) All county residents with school-aged children
- (D) All county residents with children in the county school system
- (E) All county school system teachers

5.

A manufacturer of ready-bake cake mixes is interested in designing a study to test the effects of 4 different temperature levels (300°, 325°, 350°, and 375° F), 2 different types of pans (glass and metal), and 3 different types of ovens (gas, electric, and microwave) on the texture of its cakes. How many different treatment combinations are to be used in this study?

- (A) 3
  - (B) 9
  - (C) 18
  - (D) 20
  - ☒ (E) 24
- 4 levels of temperature settings  
2 types of pans  
3 types of ovens

---

$4 \cdot 2 \cdot 3 = 24$

6.

After a frost warning was issued, the owner of a large orange grove asked his workers to spray all his trees with water. The water was supposed to freeze and form a protective covering of ice around the orange blossom. Nevertheless, the owner suspected that some trees suffered considerable damage due to the frost. To estimate the proportion of trees that suffered more than 50 percent damage due to the frost, he took a random sample of 100 trees from his grove. What constitutes an observation (measurement) in this experiment?

- (A) The proportion of trees that suffered more than 50 percent damage due to frost.
- (B) The number of trees affected by the frost.
- (C) The number of trees sampled from the grove.
- (D) For each sampled tree, whether it was sprayed with water or not sprayed with water.
- ☒ (E) For each sampled tree, whether it suffered more than 50 percent damage or at most 50 percent damage.

7.

A manufacturer of motor oil is interested in testing the effects of a newly developed additive on the lifespan of an engine. Twenty-five different engine types are selected at random and each one is tested using oil with the additive and oil without the additive. What type of analysis will yield the most useful information?

- (A) Matched pairs comparison of population proportions.
- ☒ (B) Matched pairs comparison of population means.
- (C) Independent samples comparison of population proportions.
- (D) Independent samples comparison of population means.
- (E) *Chi-square* test of homogeneity.

8.

An insurance agent is successful in selling a life insurance policy to 20 percent of the customers he contacts. He decides to construct a simulation to estimate the mean number of customers he needs to contact before being able to sell a policy. Which of the following schemes should he use to do the simulation?

- ☒ (A) Assign numbers "0, 1" to successfully selling a policy to a customer and numbers "2, 3, 4, 5, 6, 7, 8, 9" to failing to sell a policy to a customer.
- (B) Assign numbers "0, 1" to successfully selling a policy to a customer and numbers "2, 3, 4" to failing to sell a policy to a customer.
- (C) Assign number "0" to successfully selling a policy to a customer and number "1" to failing to sell a policy to a customer.
- (D) Assign numbers "0, 1, 2, 3, 4" to successfully selling a policy to a customer and numbers "5, 6, 7, 8, 9" to failing to sell a policy to a customer.
- (E) Assign number "20" to successfully selling a policy to a customer and numbers "1, 3, 5, 7, 9, 11, 13, 15, 17, 19" to failing to sell a policy to a customer.

9.

In a clinical trial, 30 sickle cell anemia patients are randomly assigned to two groups. One group receives the currently marketed medicine, and the other group receives an experimental medicine. Each week patients report to the clinic where blood tests are conducted. The lab technician is unaware of the kind of medicine the patient is taking. This design can be described as

- ☒ (A) a completely randomized design, with the currently marketed medicine and the experimental medicine as two treatments
- (B) a matched-pairs design, with the currently marketed medicine and the experimental medicine forming a pair
- (C) a randomized block design, with the currently marketed medicine and the experimental medicine as two blocks
- (D) a randomized block design, with the currently marketed medicine and the experimental medicine as two treatments
- (E) a stratified design with two strata, patients with sickle cell disease forming one stratum and those without sickle cell disease forming the other stratum

10.

A newspaper reporter examined police reports of accidents during the past 12 months to collect data about the speed of a car and its stopping distance. The reporter then constructed a scatterplot and computed a correlation coefficient to show the relation between a car's speed and its stopping distance. This is an example of

- (A) a double-blind study
- (B) a single-blind study
- (C) a study involving no blinding at all
- ☒ (D) an observational study
- (E) a well-designed experiment

11.

In a clinic, 50 patients with sleep disorders are randomly assigned to one of two different groups. Patients in one group are given medication before bedtime. Patients in the other group are given blindfolds and played soft music at bedtime. Each patient is attached to a machine that records breathing patterns. From the patterns, it is possible to determine if the patient is awake or asleep. The data will be used to decide which method is more effective in helping patients with sleep disorders. Which of the following statements is correct in the context of this experiment?

- (A) This is a single blind experiment, because only one group uses blindfolds.
- (B) This is a single blind experiment, because only patients and not doctors use blindfolds.
- (C) This is a double blind experiment, since patients are blindfolded and the doctor does not know which patient receives which treatment.
- (D) This experiment cannot be a single blind experiment, because many patients do not like to be blindfolded.
- ☒ (E) This experiment cannot be a double blind experiment, because patients will know which treatment they are receiving, although the examining doctor might not.

12. Which of the following is the best description of a systematic random sample?

- (A) A sample chosen in such a way that every possible sample of a given size has an equal chance to be the sample.
- (B) After a population is separated into district groups, one or more of these groups are randomly selected in their entirety to be the sample.
- ☒ (C) A value is randomly selected from an ordered list and then every  $n$ th value in the list after the first value is selected for the sample.
- (D) Select a sample in such a way that the proportion of some variables thought to impact the response is approximately the same in the sample as in the population.
- (E) A sample in which the respondents volunteer their response.

13. In the famous study from the late 1920s, the Western Electric Company wanted to study the effect of lighting on productivity. They discovered that worker productivity increased with each change of lighting, whether the lighting was increased or decreased. The workers were aware that a study was in

progress. What is the most likely cause of this phenomenon? (This effect is known as the Hawthorne Effect.)

- ☒ (A) Response bias
- (B) Absence of a control group
- (C) Lack of randomization
- (D) Sampling variability
- (E) Undercoverage

14. A study is to be conducted on a new weather proofing product for outdoor decks. Four houses with outdoor decks in one suburban neighborhood are selected for the study. Each deck is to be divided into two halves, one half receiving the new product and the other half receiving the product the company currently has on market. Each of the four decks is divided into North/South sections. Either the new or the old product is randomly assigned the North side of each of the decks and the other product is assigned to the South side. The major reason for doing this is that

- (A) the study is much too small to avoid using randomization
- (B) there are only two treatments being studied.
- (C) this controls for known differences in the effect of the sun on the North and South sides of decks.
- (D) randomization is necessary elements of any experiment.
- ☒ (E) this controls for the unknown differential effects of the weather on the North and South sides of decks in this neighborhood.

15. Which of the following best describes a cluster sample size 20 from a population of size 320?

- (A) All 320 names are written on slips of paper and the slips are put into a box. Twenty slips are selected at random from the box.
- (B) The 320 names are put into an alphabetical list. One of the first 6 names on the list is selected at random as part of the sample. Every 16<sup>th</sup> name on the list is then selected for the sample.
- (C) The sample will consist of the first 20 people who volunteer to be part of the sample
- (D) Each of the 320 people is assigned a number. Twenty numbers are randomly selected by a computer and the people corresponding to these 20 numbers are the sample.
- ☒ (E) The 320 names are put into an alphabetical list and the list numbered from 1 to 320. A number between 1 and 304 (inclusive) is selected at random. The person corresponding to that number and the next 19 people on the list are selected for the sample.

16. You are going to conduct an experiment to determine which of four different brands of cat food promotes growth best for kittens ages 4 months to 1 year. You are concerned that the effect might vary by the breed of the cat, so you divide the cats into three different categories by breed. This gives you eight kittens in each category. You randomly assign two of the kittens in each category to one of the four foods. The design of this study is best described as:

- (A) randomized block, blocked by breed of cat and type of cat food.
- (B) randomized block, blocked by type of cat food.
- (C) matched pairs where each two cats are considered a pair.
- (D) a controlled design in which the various breeds of cats are the controls.
- ☒ (E) randomized block, blocked by breed of cat.

17. You want to conduct a survey to determine the types of exercise equipment most used by people at your health club. You plan to base your results on a random sample of 40 members. Which of the following methods will generate a simple random sample of 40 members?

- (A) Mail out surveys to every member and use the first 40 that are returned as your sample.
- (B) Randomly pick a morning and survey the first 40 people who come in the door that day.
- (C) Divide the number of members by 40 to get a value  $k$ . Choose one of the first  $k$ th names on the list using a random number generator. Then choose every  $k$ th name on the list after that name.
- ☒ (D) Put each member's name on a slip of paper and randomly select 40 slips.
- (E) Get the sign-in lists for each day of the week, Monday through Friday. Randomly choose 8 names from each day for the survey.

18. An advice columnist asks readers to write in about how happy they are in their marriages. The results indicate that 79% of those responding would not marry the same partner if they had to do it all over again. Which of the following statements is most correct?

- (A) It's likely that this result is an accurate reflection of the population.
- ☒ (B) It's likely that this result is higher than the true population proportion because persons unhappy in their marriages are most likely to respond.
- (C) It's likely that this result is lower than the true population proportion because persons unhappy in their marriages are unlikely to respond.
- (D) It's likely that the results are not accurate because people tend to lie in voluntary response surveys.
- (E) There is really no way of predicting whether the results are biased or not.

19. You are interested in determining which of two brands of tires (call them Brand G and Brand F) last longer under differing conditions of use. Fifty Toyota Camry's are fitted with Brand G tires and 50 Honda Accords are fitted with Brand F tires. Each tire is driven 20,000 miles, and tread wear is measured for each tire, and the average tread wear for the two brands is compared. What is wrong with this experimental design?

- ☒ (A) The type of car is a confounding variable
- (B) Average tread wear is not a proper measure for comparison.
- (C) The experiment should have been conducted on more than two brands of cars.
- (D) Not enough of each type of tire was used in the study.
- (E) Nothing is wrong with this design – it should work quite well to compare the two brands of tires.

20. A psychiatrist is studying the effects of regular exercise on stress reduction. She identifies 40 people who exercise regularly and 40 who do not. Each of the 80 people is given a questionnaire designed to determine stress levels. None of the 80 people who participated in the study knew that they were part of a study. Which of the following statement is true?

- ☒ (A) This is an observational study.
- (B) This is a randomized comparative experiment.
- (C) This is a double-blind study.
- (D) This is a matched-pairs design.
- (E) This is an experiment in which exercise level is a blocking variable.

#1

## Question 5

**Intent of Question**

The primary goals of this question are to evaluate a student's ability to: (1) identify the treatments in a biological experiment; (2) present a completely randomized *design* to address the research question of interest; (3) describe the benefit of limiting sources of variability; and (4) describe the limitations to the scope of inference for the biologist.

**Solution****Part (a):**

The three different growth-enhancing nutrients (A, B, and C) and two different salinity levels (low and high) yield a total of  $3 \times 2 = 6$  different treatment combinations for this experiment.

Treatment Combination	Nutrient	Salinity Level
1	A	Low
2	A	High
3	B	Low
4	B	High
5	C	Low
6	C	High

**Part (b):**

Since 10 tiger shrimps have already been randomly placed into each of 12 similar tanks in a controlled environment, we must randomly assign the treatment combinations to the tanks. Each treatment combination will be randomly assigned to 2 of the 12 tanks. One way to do this is to generate a random number for each tank. The treatment combinations are then assigned by sorting the random numbers from smallest to largest.

Treatment Combination	Nutrient	Salinity Level	Tanks with
1	A	Low	Smallest and second smallest random numbers
2	A	High	Third and fourth smallest random numbers
3	B	Low	Fifth and sixth smallest random numbers
4	B	High	Seventh and eighth smallest random numbers
5	C	Low	Ninth and tenth smallest random numbers
6	C	High	Next to largest and largest random numbers

**AP<sup>®</sup> STATISTICS  
2006 SCORING GUIDELINES**

**Question 5 (continued)**

After three weeks the weight gain (after – before) is computed for each tank, and the treatments are compared using appropriate averages.

**Part (c):**

Using only tiger shrimp will reduce a source of variation in the experimental units, the tanks of shrimp in this experiment. By eliminating this possible source of variation, type of shrimp, we are better able to isolate the variability due to the factors of interest to us (nutrient and salinity level). This will make it easier to identify any treatment effects that may be present.

**Part (d):**

Using only tiger shrimp will limit the scope of inference for the biologist. Ideally, the biologist would like to identify the treatment combination that leads to the most growth for all shrimp. However, the biologist will only be able to identify the best treatment combination for tiger shrimp because other types of shrimp may respond differently to the treatments.

**Scoring**

Part (a) is scored as essentially correct (E) or incorrect (I). Parts (b), (c), and (d) are scored as essentially correct (E), partially correct (P), or incorrect (I).

**Part (a)** is essentially correct (E) if all six treatments are correctly listed. This may be done in a 2 x 3 table or tree diagram but must clearly indicate the six treatments. A correct but incomplete listing of treatments in part (a) can be recovered in part (b) if the six treatments are clearly stated.

Listing the factors (nutrients A, B, C and salinity high, low) is incorrect and cannot be recovered in part (b).

**Part (b)** is essentially correct (E) if:

- each treatment combination is randomly assigned to 2 of the 12 tanks  
AND
- a correct procedure for randomization is described (so that two knowledgeable statistics users would use the same method to assign treatments to the tanks).

Part (b) is partially correct (P) if only one of these components is present. For example,

- Each treatment is randomly assigned to 2 of the 12 tanks, but the method of randomization is not fully described (i.e., just say randomly assign each treatment to 2 of the 12 tanks).  
OR
- A correct procedure for randomization of the treatments to the tanks is described, but each treatment does not necessarily appear twice.

Part (b) is incorrect (I) if there is no randomization or randomization of treatments is applied to the shrimps only (not the tanks).

**AP<sup>®</sup> STATISTICS  
2006 SCORING GUIDELINES**

**Question 5 (continued)**

Notes:

- If the randomization has been correctly applied to the tanks, additionally randomizing the shrimps or treatments will be regarded as extraneous.
- Because the stem indicates shrimp growth is to be compared, students are not required to identify a response variable in part (b) as was done in the model solution.

**Part (c)** is essentially correct (E) if

- the statistical advantage of reduced variability is identified  
AND
- an appropriate explanation that relates reduced variability to increasing the likelihood of determining differences among treatments is clearly provided.

Part (c) is partially correct (P) if only one of the two components is correct.

Part (c) is incorrect (I) if neither of the two components is present.

Notes:

- In this completely randomized design, confounding is not possible. Therefore a reference to confounding or lurking variables always incurs a penalty.

**Part (d)** is essentially correct (E) if

- the statistical disadvantage of limited scope of inference is identified  
AND
- an explanation that different species of shrimp may respond differently to treatments is provided.

(If the different responses to the treatments by other species of shrimp have been established in part (c), then it need not be repeated in part (d).)

Part (d) is partially correct (P) if only one of the two parts of the essentially correct response is provided.

Part (d) is incorrect (I) if neither of the two parts of the essentially correct response is provided,

- |          |                             |
|----------|-----------------------------|
| <b>4</b> | <b>Complete Response</b>    |
| <b>3</b> | <b>Substantial Response</b> |
| <b>2</b> | <b>Developing Response</b>  |
| <b>1</b> | <b>Minimal Response</b>     |

**If a response is between two scores (for example, 2½ points) use a holistic approach to determine whether to score up or down depending on the strength of the response and communication. The strength of the responses in parts (b) and (c) may be most important in making this choice.**

**AP<sup>®</sup> STATISTICS**  
**2010 SCORING GUIDELINES (Form B)**

**Question 2**

**Intent of Question**

The primary goals of this question were to assess students' ability to (1) describe a simple random sampling procedure; (2) identify an effective stratification variable; (3) provide a statistical advantage of a stratified random sample over a simple random sample in context.

**Solution**

**Part (a):**

The administrators could number an alphabetical list of students from 1 to 2,500. They could then use a random number generator from a calculator or computer to generate 200 unique random integers from 1 to 2,500. The students corresponding to those 200 numbers would be asked to participate in the survey.

**Part (b):**

One possible stratification variable might be the school level of the student (elementary, middle, high school). The students' perceptions of the importance of good nutrition in food served may differ depending on the students' ages and therefore on school levels. For example, there may be a difference between what elementary students value in food served as opposed to middle school and high school students.

**Part (c):**

One statistical advantage of using stratified random sampling as opposed to simple random sampling is, for example, if the elementary, middle and high school strata create groups that differ with respect to what they value — and are therefore more homogeneous with respect to opinion on this issue — then for the same overall sample size a more accurate estimate of the overall proportion of students who are satisfied with the food under this contract may result. Another advantage is that stratified random sampling guarantees that each of the school-level strata will have some representation, because it is possible that a simple random sample would miss one or more of the strata completely.

**Scoring**

Parts (a), (b) and (c) are each scored as essentially correct (E), partially correct (P) or incorrect (I).

**Part (a)** is scored as follows:

Essentially correct (E) if the response describes a sampling procedure for generating a simple random sample and the description of the sampling procedure includes sufficient detail for implementation.

Partially correct (P) if random selection is used correctly for generating a simple random sample, but the description of the sampling procedure does not provide sufficient detail for implementation.

Incorrect (I) if random selection is not used in a correct way for a simple random sample.

*Note:* A response in which objects are placed into a hat or a box and then drawn out can only earn an "E" if the response explicitly states that the objects are mixed or that they are drawn out at random.

**AP<sup>®</sup> STATISTICS**  
**2010 SCORING GUIDELINES (Form B)**

**Question 2 (continued)**

**Part (b)** is scored as follows:

Essentially correct (E) if the response identifies a reasonable stratification variable and provides a reasonable justification in context (such as stating, “the groups (strata) might differ *with respect to food preferences or nutritional awareness*”).

Partially correct (P) if the response identifies a reasonable stratification variable but provides a weak justification (such as stating only, “the groups (strata) differ”).

Incorrect (I) if the response identifies an unreasonable stratification variable, or provides an unreasonable justification or no justification.

**Part (c)** is scored as follows:

Essentially correct (E) if the response provides a reasonable statistical advantage of stratified random sampling that is not also true of random sampling, and that is clearly communicated and in context.

Partially correct (P) if the response provides a reasonable statistical advantage that is either not well communicated or that is not in context.

Incorrect (I) if the response includes only a vague potential statistical advantage, such as “data more accurate” or “stratified random sampling is better.”

*Note:* Responses to part (c) such as “stratified random sampling allows for inferences to be drawn for the three grade levels separately about the feelings of students in those grade levels” should be considered incorrect unless also accompanied by a statistical advantage specific to stratified random sampling.

**4            Complete Response**

All three parts essentially correct

**3            Substantial Response**

Two parts essentially correct and one part partially correct

**2            Developing Response**

Two parts essentially correct and one part incorrect  
OR  
One part essentially correct and one or two parts partially correct  
OR  
Three parts partially correct

**1            Minimal Response**

One part essentially correct and two parts incorrect  
OR  
Two parts partially correct and one part incorrect

**AP<sup>®</sup> 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.

**AP<sup>®</sup> STATISTICS  
2004 SCORING GUIDELINES**

**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).

**AP<sup>®</sup> STATISTICS  
2004 SCORING GUIDELINES**

**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.