

**AP<sup>®</sup> STATISTICS**  
**2011 SCORING GUIDELINES (Form B)**

**Question 2**

**Intent of Question**

The primary goals of this question were to assess students' ability to (1) distinguish an experiment from an observational study; (2) critique statistical information, in particular whether or not researchers are justified in making a specific conclusion based on the given information; (3) recognize and describe a potential problem with a study that lacks random assignment or blinding.

**Solution**

**Part (a):**

The study was an experiment because treatments (D-cycloserine or placebo) were imposed by the researchers on the people with acrophobia.

**Part (b):**

No, the experiment was designed to compare the D-cycloserine group with a control group that received the placebo. The researchers can conclude that the D-cycloserine pill and two therapy sessions show significantly more improvement than a placebo and two therapy sessions. However, there is no basis for comparison with another group of people with acrophobia who received eight therapy sessions and no pill.

**Part (c):**

One example is that if the therapists were allowed to choose who received the placebo and who received D-cycloserine, they might assign the people with more severe acrophobia to one of the groups and the people with less severe acrophobia to the other group. Thus, the improvement after only two therapy sessions could be related to the initial severity of the acrophobia rather than to the effects of D-cycloserine.

**Scoring**

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

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

Essentially correct (E) if the response indicates that this was an experiment, *AND* the explanation clearly communicates that two treatments were imposed.

Partially correct (P) if the response indicates that this was an experiment, *BUT* the explanation does not clearly communicate that two treatments were imposed.

*Note:* If the response indicates that this was an experiment because there was random assignment *to treatments*, this implies imposition of treatments and is scored as E. If the response does not clearly state that the random assignment is *to treatments*, this is scored as P.

Incorrect (I) if the response indicates that this is an observational study *OR* if the explanation is missing or incorrect.

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**Question 2 (continued)**

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

Essentially correct (E) if the response says “no” *AND* clearly explains why this is not reasonable based on the fact that there was no experimental group that received eight therapy sessions and no pill.

Incorrect (I) if the response provides an answer with an incorrect or no justification.

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

Essentially correct (E) if the response indicates that this method of assignment might create experimental groups that differ in some systematic way other than the treatment *AND* provides a justification that describes the potential confounding,

*OR*

if the response indicates that if the therapists know who was in which group, it may influence the therapists’ behavior when dealing with or evaluating the people with acrophobia.

Partially correct (P) for any of the following:

- The response indicates that the assignment might create experimental groups that differ in some systematic way, *BUT* does not provide an explanation of the potential confounding.
- The response makes a general statement that the lack of random assignment could lead to confounding *BUT* does not provide an example in context.
- The response indicates that the therapists know who is in which group *BUT* does not give a reason as to why this might lead to a misleading conclusion.
- The response makes a general statement that failure to blind may lead to bias *BUT* does not provide an example in context.

Incorrect (I) if the response fails to meet the criteria for E or P.

*Note:* If the response discusses incorrect conclusions that might result from having the *people with acrophobia* (rather than the *therapists*) choose their own treatments, the response is scored as I, because such a response does not address the question asked.

**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.

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**Question 2 (continued)**

**1 Minimal Response**

One part essentially correct and two parts incorrect

*OR*

One or two parts partially correct and one part incorrect

2. People with acrophobia (fear of heights) sometimes enroll in therapy sessions to help them overcome this fear. Typically, seven or eight therapy sessions are needed before improvement is noticed. A study was conducted to determine whether the drug D-cycloserine, used in combination with fewer therapy sessions, would help people with acrophobia overcome this fear.

Each of 27 people who participated in the study received a pill before each of two therapy sessions. Seventeen of the 27 people were randomly assigned to receive a D-cycloserine pill, and the remaining 10 people received a placebo. After the two therapy sessions, none of the 27 people received additional pills or therapy. Three months after the administration of the pills and the two therapy sessions, each of the 27 people was evaluated to see if he or she had improved.

- (a) Was this study an experiment or an observational study? Provide an explanation to support your answer.

This was an experiment, as the subjects were assigned their treatments by the people conducting the study.

- (b) When the data were analyzed, the D-cycloserine group showed statistically significantly more improvement than the placebo group did. Based on this result, would the researchers be justified in concluding that the D-cycloserine pill and two therapy sessions are as beneficial as eight therapy sessions without the pill? Justify your answer.

No, because that was not one of the treatments monitored by the study. Both the D-cycloserine and the placebo group participated in only 2 therapy sessions.

- (c) A newspaper article that summarized the results of this study did not explain how it was determined which people received D-cycloserine and which received the placebo. Suppose the researchers allowed the therapists to choose which people received D-cycloserine and which received the placebo, and no randomization was used. Explain why such a method of assignment might lead to an incorrect conclusion.

The therapists might group the participants based on similar traits, such as fear intensity, which would seriously affect the results. Also, the therapists would know which participants were actually taking the D-cycloserine, and might adjust the therapy accordingly. The experiment would not be double blind.

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Each of 27 people who participated in the study received a pill before each of two therapy sessions. Seventeen of the 27 people were randomly assigned to receive a D-cycloserine pill, and the remaining 10 people received a placebo. After the two therapy sessions, none of the 27 people received additional pills or therapy. Three months after the administration of the pills and the two therapy sessions, each of the 27 people was evaluated to see if he or she had improved.

- (a) Was this study an experiment or an observational study? Provide an explanation to support your answer.

This study is an experiment, because it separates subjects into control group and experimental group and has manipulated independent variable as well as dependent variable to be observed.

- (b) When the data were analyzed, the D-cycloserine group showed statistically significantly more improvement than the placebo group did. Based on this result, would the researchers be justified in concluding that the D-cycloserine pill and two therapy sessions are as beneficial as eight therapy sessions without the pill? Justify your answer.

No, because the study controls whether or not subjects receive D-cycloserine and watch its effect followed by two therapy sessions, we can only conclude that D-cycloserine can improve patients' condition when they receive same sessions of therapy, but we cannot say the pills and two sessions is better than eight sessions.

- (c) A newspaper article that summarized the results of this study did not explain how it was determined which people received D-cycloserine and which received the placebo. Suppose the researchers allowed the therapists to choose which people received D-cycloserine and which received the placebo, and no randomization was used. Explain why such a method of assignment might lead to an incorrect conclusion.

If the therapists are allowed to choose which people receive medicine, the subject-relevant confounding variables can not be evenly distributed between two groups. Thus, the study's result will be affected by these differences.

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Each of 27 people who participated in the study received a pill before each of two therapy sessions. Seventeen of the 27 people were randomly assigned to receive a D-cycloserine pill, and the remaining 10 people received a placebo. After the two therapy sessions, none of the 27 people received additional pills or therapy. Three months after the administration of the pills and the two therapy sessions, each of the 27 people was evaluated to see if he or she had improved.

- (a) Was this study an experiment or an observational study? Provide an explanation to support your answer.

This was an experiment, because the researcher directly introduced a variable (the drug) to see its effects on the subjects being studied.

- (b) When the data were analyzed, the D-cycloserine group showed statistically significantly more improvement than the placebo group did. Based on this result, would the researchers be justified in concluding that the D-cycloserine pill and two therapy sessions are as beneficial as eight therapy sessions without the pill? Justify your answer.

Since we <sup>can be confident</sup> ~~are~~ that this improvement is due to the drug, researchers will be justified enough in such conclusions. However, they could conduct more trials of this experiment to ~~be~~ become more confident.

- (c) A newspaper article that summarized the results of this study did not explain how it was determined which people received D-cycloserine and which received the placebo. Suppose the researchers allowed the therapists to choose which people received D-cycloserine and which received the placebo, and no randomization was used. Explain why such a method of assignment might lead to an incorrect conclusion.

That would create a bias, because if each therapist chose to diagnose the drug to people with comparatively less fear, then the ~~results~~ <sup>drug's effects</sup> would be overestimated. (People may be getting better faster, not because of the drug but because they had less fear to begin with.)

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**2011 SCORING COMMENTARY (Form B)**

**Question 2**

**Sample: 2A**

**Score: 4**

In part (a) the response indicates that subjects were assigned treatments by the researchers and that there was more than one treatment. Part (a) was scored as essentially correct. Part (b) is answered concisely and correctly by noting that the eight therapy sessions without the pill was not one of the treatments included in the study. Part (b) was scored as essentially correct. The first sentence in part (c) correctly indicates that allowing the therapists to assign people to groups might result in experimental groups that differ in “fear intensity,” but it is not accompanied by an explanation of how this potential confounding could lead to an incorrect conclusion. However, the second and third sentences in part (c) indicate that allowing the therapists to assign people to groups would compromise double-blinding, with the consequence that the therapists might “adjust the therapy accordingly.” The statement that the therapists’ behavior when dealing with the people with acrophobia might be influenced by their knowledge of treatment assignments was considered adequate explanation of why an incorrect conclusion might be reached, and part (c) was scored as essentially correct. Because three parts were scored as essentially correct, the response earned a score of 4.

**Sample: 2B**

**Score: 3**

In part (a) the response indicates correctly that the study was an experiment because the independent variable was “manipulated” and the dependent variable was “to be observed.” The response also indicates that there was a “control group and experimental group.” Part (a) was scored as essentially correct. Part (b) was answered correctly by noting that because the study includes only treatments with two therapy sessions, conclusions can be made only about treatments with two therapy sessions. Part (b) was scored as essentially correct. The response in part (c) indicates that lack of random assignment could lead to confounding, but no example in the context of the study is provided. Part (c) was scored as partially correct. Because two parts were scored as essentially correct and one part was scored as partially correct, the response earned a score of 3.

**Sample: 2C**

**Score: 2**

The response in part (a) indicates that the study was an experiment “because the researcher directly introduced a variable (the drug) to see its effects on the subjects.” Although this response suggests imposition of a treatment, it does not clearly communicate that two treatments were imposed, and part (a) was scored as partially correct. In part (b) the response incorrectly states that the researchers would be justified in reaching a conclusion about eight therapy sessions, so part (b) was scored as incorrect. The response in part (c) indicates that if therapists are permitted to assign the people with acrophobia to treatment groups, they might assign those with less fear to the D-cycloserine group, which could result in overestimation of the effectiveness of the drug. This is a clear explanation of potential confounding, and part (c) was scored as essentially correct. Because one part was scored as essentially correct, one part was scored as partially correct, and one part was scored as incorrect, the response earned a score of 2.