Unit 3 Progress Check: FRQ

1. Show all your work. Indicate clearly the methods you use, because you will be scored on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

Researchers are investigating whether people who exercise with a training partner have a greater increase, on average, in targeted exercise intensity compared with people who exercise alone. Two methods of collecting data have been proposed.

Method I: Recruit volunteers who are willing to participate. Randomly assign each participant to exercise with a training partner or to exercise alone.

Method II: Select a random sample of people from all the people who exercise at a community fitness center. Ask each person in the sample whether they use a training partner, and use the response to create the two groups.

(a) For each method, the researchers will record the change in targeted exercise intensity for each person in the investigation. They will compare the mean change in intensity between those who exercise with a training partner and those who do not.

(i) Describe the population of generalization if method I is used. Explain your answer.

(ii) Describe the population of generalization if method II is used. Explain your answer.

(b) Suppose the investigation produces a result that is statistically significant using both methods. What can be concluded if method I is used that cannot be concluded if method II is used? Explain your answer.

Part A and B

The primary goals of this question are to assess a student's ability to (1) identify the population to which a study can be generalized and (2) compare the results of an observational study and experiment.

Scoring

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

✓

0	1	2	3	4

Both parts essentially correct

- ☐ Part (a) essentially correct
- ☐ Part (a) partially correct
- ☐ Part (a) incorrect
- ☐ Part (b) essentially correct
- ☐ Part (b) partially correct
- ☐ Part (b) incorrect

Unit 3 Progress Check: FRQ

Solution

Part (a-i):

For method I, the results of the study apply to the volunteers and can only be generalized to the population of all people who would volunteer to participate in an exercise intensity study, because there is not random selection from a population of interest.

Part (a-ii):

For method II, the results of the study can be generalized to all people who exercise at the community fitness center, because the sample was selected at random from all the people who exercise at a community fitness center.

Scoring

Part (a) is scored as follows.

Essentially correct (E) if the response contains all four of the following components:

· The correct population for method I

· The correct justification for method I

· The correct population for method II

· The correct justification for method II

Partially correct (P) if the response contains only two or three of the four components

Incorrect (I) if the response does not satisfy the criteria for E or P

Solution

Part (b): With method I, the researchers will be able to conclude that exercising with a training partner causes a greater increase in the change in targeted exercise intensity, on average, than exercising alone does. This cause-and-effect conclusion can be made with method I because each volunteer was randomly assigned to one of two treatments. With method II, the participants are not randomly assigned to the treatments. Therefore, a cause-and-effect conclusion is not appropriate.

Scoring

Part (b) is scored as follows.

Essentially correct (E) if the cause-and-effect conclusion is correctly described in the context of the problem, with justification based on random assignment of treatments

Partially correct (P) if the response indicates that a cause-and-effect conclusion is possible because randomization of treatments was used, but the response does not put the solution in the context of this problem, OR if the response indicates that a cause-and-effect conclusion is possible but does not mention random assignment as the justification

Incorrect (I) if the response does not satisfy the criteria for E or P

Unit 3 Progress Check: FRQ

Notes:A response that identifies method I as an experiment and method II as an observational study has correctly identified each method. However, a response that only identifies method I as an experiment without referring to random assignment would be scored as P.

Unit 3 Progress Check: FRQ

2. Show all your work. Indicate clearly the methods you use, because you will be scored on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.

A survey was given to a random sample of 400 people living in a certain community. The people were asked whether they supported the construction of walking trails in the community park. The results are shown in the following table.

Response	Frequency
Yes, support	210
No, do not support	90
No opinion	100
Total	400

(a) Complete the following segmented bar chart to show the relative frequencies of the results.
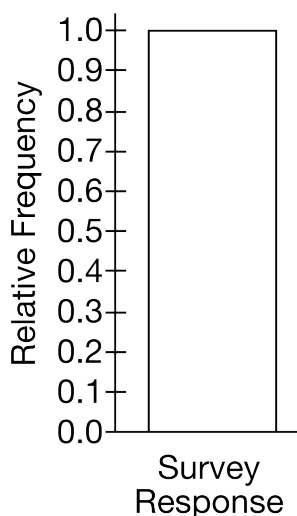
A follow-up study will be conducted with a sample of 20 people from the 300 people who responded yes (support) and no (do not support). Two sampling methods have been proposed: a simple random sample and a stratified random sample with the survey response as strata.

(b) If the stratified random sample is used, what is the number of people that will be selected from those who responded yes? Support your answer by showing your work.

(c) Describe a statistical advantage of using the stratified random sample instead of the simple random sample for the follow-up study.

Part A, B, and C

Unit 3 Progress Check: FRQ

The primary goals of this question are to assess a student's ability to (1) create a segmented bar graph to represent data graphically and (2) compare a simple random sampling method with a stratified random sampling method.

Scoring

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

✓

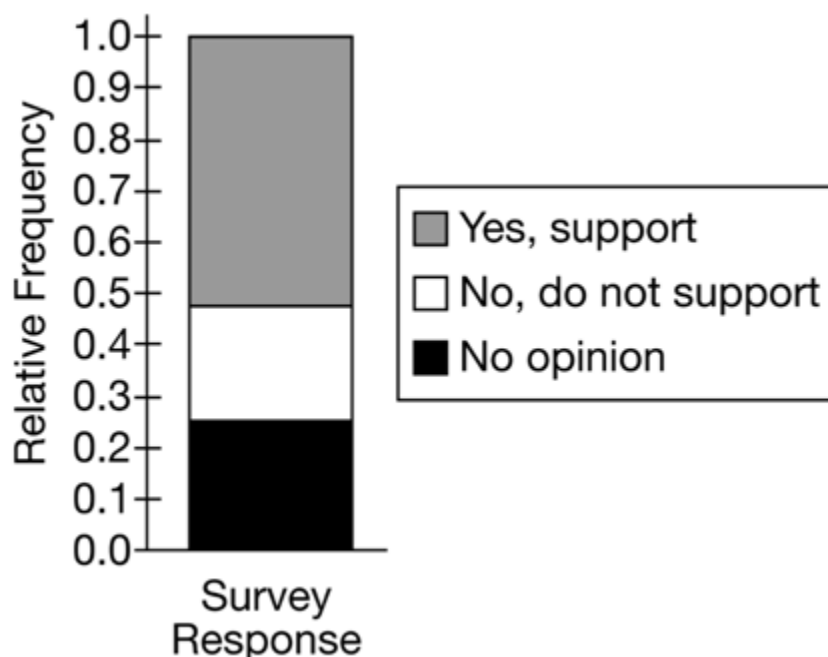| 0	1	2	3	4

All three parts essentially correct

- ☐ Part (a) essentially correct
- ☐ Part (a) partially correct
- ☐ Part (a) incorrect
- ☐ Part (b) essentially correct
- ☐ Part (b) partially correct
- ☐ Part (b) incorrect
- ☐ Part (c) essentially correct
- ☐ Part (c) partially correct
- ☐ Part (c) incorrect

Solution

Part (a):

Unit 3 Progress Check: FRQ

Scoring

Part (a) is scored as follows.

Essentially correct (E) if the response includes the following two components:

· Lines drawn at appropriate places in the graph

· Appropriate labels provided for segments in the graph

Partially correct (P) if the response includes only one of the two components

Incorrect(I) if the response does not satisfy the criteria for E or P

Solution

Part (b): The proportion of adults from the sample of 300 adults who responded to the survey and indicated they support the construction of the walking trails is $\frac{210}{300} = 0.7.$ Therefore, to ensure that each adult has an equal chance of being selected for the in-depth study, 14 adults must be selected from those who responded yes, because $(0.7)(20) = 14$

Scoring

Part (b) is scored as follows.

Essentially correct (E) if the response indicates the correct value AND work to support the calculation

Partially correct (P) if the response indicates the correct value but uses weak work to support the calculation

Incorrect(I) if the response does not indicate a correct value

OR

Unit 3 Progress Check: FRQ

If the response indicates a correct value with no supporting work

Solution

Part (c): A statistical advantage of using the stratified random sample instead of the simple random sample is that it allows for representation of the two survey responses to be in identical proportion to the responses of the 300 people who responded yes (support) and no (do not support). A simple random sample may produce a sample that will not be in identical proportion to the responses of the 300 people who responded yes (support) and no (do not support). For example, a simple random sample may produce a sample of 20 adults who responded the same way.

Scoring

Part (c) is scored as follows.

Essentially correct (E) if the response provides a reasonable statistical advantage of using the stratified random sample relative to the simple random sample in the context of potential variability across survey responses

Partially correct (P) if the response indicates that stratification allows for better representation in the sample but DOES NOT address variation across responses

Incorrect(I) if the response does not satisfy the criteria for E or P, including giving only vague statements such as "data are more accurate" or "stratified random sampling is better"

Note: An example of a reasonable statistical advantage of a stratified sample over a simple random sample is:

· Stratified random sampling tends to produce a sample that is more representative of the population because it must contain the same percentage of adults from each survey response.