

# Study Session Week of 11/27

## Objectives:

- I will apply previous knowledge to solve multiple choice questions involving experimental design.

## Agenda:

- MC practice problems

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1. When travelers change airlines during connecting flights, each airline receives a portion of the fare. Several years ago, the major airlines used a sample trial period to determine what percentage of certain fares each should collect. Using these statistical results to determine fare splits, the airlines now claim huge savings over previous clerical costs. Which of the following is true?
- I. The airlines ran an experiment using a trial period for the control group.
  - II. The airlines ran an observational study using the calculations from a trial period as a sample.
  - III. The airlines feel that any monetary error in fare splitting resulting from using a statistical sample is smaller than the previous clerical costs necessary to calculate exact fare splits.
- (A) I only  
(B) II only  
(C) III only  
(D) I and III  
(E) II and III

2. Which of the following are true statements?

- I. In an experiment some treatment is intentionally forced on one group to note the response.
- II. In an observational study information is gathered on an already existing situation.
- III. Sample surveys are observational studies, not experiments.

- (A) I and II
- (B) I and III
- (C) II and III
- (D) I, II, and III
- (E) None of the above gives the complete set of true responses.

3. Which of the following are true statements?

- I. In an experiment researchers decide how people are placed in different groups.
- II. In an observational study, the people themselves select which group they are in.
- III. A control group is most often a self-selected grouping in an experiment.

- (A) I and II
- (B) I and III
- (C) II and III
- (D) I, II, and III
- (E) None of the above gives the complete set of true responses.

4. In one study on the effect of niacin on cholesterol level, 100 subjects who acknowledged being long-time niacin takers had their cholesterol levels compared with those of 100 people who had never taken niacin. In a second study, 50 subjects were randomly chosen to receive niacin and 50 were chosen to receive a placebo.
- (A) The first study was a controlled experiment, while the second was an observational study.
  - (B) The first study was an observational study, while the second was a controlled experiment.
  - (C) Both studies were controlled experiments.
  - (D) Both studies were observational studies.
  - (E) Each study was part controlled experiment and part observational study.

5. In one study subjects were randomly given either 500 or 1000 milligrams of vitamin C daily, and the number of colds they came down with during a winter season was noted. In a second study people responded to a questionnaire asking about the average number of hours they sleep per night and the number of colds they came down with during a winter season.
- (A) The first study was an experiment without a control group, while the second was an observational study.
  - (B) The first was an observational study, while the second was a controlled experiment.
  - (C) Both studies were controlled experiments
  - (D) Both studies were observational studies.
  - (E) None of the above is a correct statement.

6. In a 1992 London study, 12 of 20 migraine sufferers were given chocolate whose flavor was masked by peppermint, while the remaining eight sufferers received a similar-looking, similar-tasting tablet that had no chocolate. Within 1 day, five of those receiving chocolate complained of migraines, while no complaints were made by any of those who did not receive chocolate. Which of the following is a true statement?
- (A) This study was an observational study of 20 migraine sufferers in which it was noted how many came down with migraines after eating chocolate.
  - (B) This study was a sample survey in which 12 out of 20 migraine sufferers were picked to receive peppermint-flavored chocolate.
  - (C) A census of 20 migraine sufferers was taken, noting how many were given chocolate and how many developed migraines.
  - (D) A study was performed using chocolate as a placebo to study one cause of migraines.
  - (E) An experiment was performed comparing a treatment group that was given chocolate to a control group that was not.

7. Suppose you wish to compare the average class size of mathematics classes to the average class size of English classes in your high school. Which is the most appropriate technique for gathering the needed data?
- (A) Census
  - (B) Sample survey
  - (C) Experiment
  - (D) Observational study
  - (E) None of these methods is appropriate.



8. Which of the following are true statements?

- I. Based on careful use of control groups, experiments can often indicate cause-and-effect relationships.
- II. While observational studies may suggest relationships, great care must be taken in concluding that there is cause and effect because of the lack of control over lurking variables.
- III. A complete census is the only way to establish a cause-and-effect relationship absolutely.

- (A) I and II
- (B) I and III
- (C) II and III
- (D) I, II, and III
- (E) None of the above gives the complete set of true responses

9. Two studies are run to compare the experiences of families living in high-rise public housing to those of families living in townhouse subsidized rentals. The first study interviews 25 families who have been in each government program for at least 1 year, while the second randomly assigns 25 families to each program and interviews them after 1 year. Which of the following is a true statement?
- (A) Both studies are observational studies because of the time period involved.
  - (B) Both studies are observational studies because there are no control groups.
  - (C) The first study is an observational study, while the second is an experiment.
  - (D) The first study is an experiment, while the second is an observational study.
  - (E) Both studies are experiments.

10. Two studies are run to determine the effect of low levels of wine consumption on cholesterol level. The first study measures the cholesterol levels of 100 volunteers who have not consumed alcohol in the past year and compares these values with their cholesterol levels after 1 year, during which time each volunteer drinks one glass of wine daily. The second study measures the cholesterol levels of 100 volunteers who have not consumed alcohol in the past year, randomly picks half the group to drink one glass of wine daily for a year while the others drink no alcohol for the year, and finally measures their levels again. Which of the following is a true statement?
- (A) The first study is an observational study, while the second is an experiment.
  - (B) The first study is an experiment, while the second is an observational study.
  - (C) Both studies are observational studies, but only one uses randomization and a control group.
  - (D) The first study is a census of 100 volunteers, while the second study is an experiment.
  - (E) Both studies are experiments.

- 11 A study is made to determine whether studying Latin helps students achieve higher scores on the verbal section of the SAT exam. In comparing records of 200 students, half of whom have taken at least 1 year of Latin, it is noted that the average SAT verbal score is higher for those 100 students who have taken Latin than for those who have not. Based on this study, guidance counselors began to recommend Latin for students who want to do well on the SAT exam. Which of the following are true

statements?

- I. While this study indicates a relation, it does not prove causation.
- II. There could be a confounding variable responsible for the seeming relationship.
- III. Self-selection here makes drawing the counselors' conclusion difficult.

E

- (A) I and II
- (B) I and III
- (C) II and III
- (D) I, II, and III
- (E) None of the above gives the complete set of true responses.

- 12 In a 1927 – 32 Western Electric Company study on the effect of lighting on worker productivity, productivity increased with each increase in lighting but then increased with every decrease in lighting. If it is assumed that the workers knew a study was in progress, this is an example of
- (A) the effect of a treatment unit.
  - (B) the placebo effect.
  - A (C) the control group effect.
  - (D) sampling error.
  - (E) voluntary response bias.

- 13 When the estrogen-blocking drug tamoxifen was first introduced to treat breast cancer, there was concern that it would cause osteoporosis as a side effect. To test this concern, cancer subjects were randomly selected and given tamoxifen, and their bone density was measured before and after treatment. Which of the following is a true statement?
- I. This study was an observational study.
  - II. This study was a sample survey of randomly selected cancer patients.
  - III. This study was an experiment in which the subjects were used as their own controls.
- A (A) I only
- B (B) II only
- (C) III only
- (D) I and II
- C (E) None of the above gives the complete set of true responses.

- 14 In designing an experiment, blocking is used
- (A) to reduce bias.
  - A (B) to reduce variation.
  - (C) as a substitute for a control group.
  - B (D) as a first step in randomization.
  - (E) to control the level of the experiment.

Which of the following are true statements about blocking?

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I. Blocking is to experiment design as stratification is to sampling design.

II. By controlling certain variables, blocking can make conclusions more specific.

III. The paired comparison design is a special case of blocking.

(A) I and II

A (B) I and III

(C) II and III

(D) I, II, and III

B (E) None of the above gives the complete set of true responses.



- 16 Consider the following studies being run by three different nursing home establishments.
- I. One nursing home has pets brought in for an hour every day to see if patient morale is improved.
  - II. One nursing home allows hourly visits every day by kindergarten children to see if patient morale is improved.
  - III. One nursing home administers antidepressants to all patients to see if patient morale is improved.
- A
- (A) None of these studies uses randomization.
  - B (B) None of these studies uses control groups.
  - (C) None of these studies uses blinding.
  - (D) Important information can be obtained from all these studies, but none will be able to establish causal relationships.
  - C (E) All of the above.

- 17 A consumer product agency tests miles per gallon for a sample of automobiles using each of four different octanes of gasoline. Which of the following is true?
- (A) There are four explanatory variables and one response variable.
  - (B) There is one explanatory variable with four levels of response.
  - (C) Miles per gallon is the only explanatory variable, but there are four response variables
  - A corresponding to the different octanes.
  - (D) There are four levels of a single explanatory variable.
  - (E) Each explanatory variable has an associated level of response.

Which of the following are true statements?

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I. In general, strong association implies causation.

II. In well-designed, well-conducted experiments, strong association implies causation.

III. Causation and association are unrelated concepts.

(A) I only

A (B) II only

(C) III only

(D) I and II

B (E) I, II, and III

Which of the following are true statements?

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I. In well-designed observational studies, responses are systematically influenced during the collection of data.

II. In well-designed experiments, the treatments result in responses that are as similar as possible.

A

III. A well-designed experiment always has a single treatment but may test that treatment at different levels.

(A) I only

E

(B) II only

(C) III only

(D) II and III

C

(E) None of these statements is true.

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Which of the following are important in the design of experiments?

- I. Control of confounding variables
- II. Randomization in assigning subjects to different treatments
- III. Replication of the experiment using sufficient numbers of subjects

- A (A) I and II
- (B) I and III
- B (C) II and III
- (D) I, II, and III
- (E) None of the above gives the complete set of true responses.

Which of the following are true about the design of matched-pairs experiments?

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- I. Each subject might receive both treatments.
- II. Each pair of subjects receives the identical treatment, and differences in their responses are noted.
- III. Blocking is one form of matched-pair design.

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

- 22 A nutritionist believes that having each player take a vitamin pill before a game enhances the performance of the football team. During the course of one season, each player takes a vitamin pill before each game, and the team achieves a winning season for the first time in several years. Is this an experiment or an observational study?
- (A) An experiment, but with no reasonable conclusion about cause and effect
  - A(B) An experiment, thus making cause and effect a reasonable conclusion
  - (C) An observational study, because there was no use of a control group
  - (D) An observational study, but a poorly designed one because randomization was not used
  - E(E) An observational study, thus allowing a reasonable conclusion of association but not cause and effect.

- 23 Some researchers believe that too much iron in the blood can raise the level of cholesterol. The iron level in the blood can be lowered by making periodic blood donations. A study is performed by randomly selecting half of a group of volunteers to give periodic blood donations while the rest do not. Is this an experiment or an observational study?
- (A) An experiment with control group and blinding
  - ^ (B) An experiment with blocking
  - (C) An observational study with comparison and randomization
  - (D) An observational study with little if any bias
  - ^ (E) None of the above



