AP Statistics - EO: Experiments & Observational Studies

AP Statistics Experiments & Observational Studies (EO) - 31 questions

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1. An advantage to using observational studies as opposed to experiments is that

(A) observational studies are generally cheaper to conduct

(B) concluding cause and effect is generally easier from observational studies

(C) observational studies are generally not subject to bias

(D) observational studies involve the use of randomization

(E) observational studies can make use of stratification

2. Two studies are run to compare the number of doctor visits of low-income families enrolled in the Children's Health Insurance Program (CHIP) to those receiving cash subsidies for health care. The first study interviews 75 families who have been in each government program for at least five years, while the second randomly assigns 75 families to each program and interviews them after five years. 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 because in each, families are receiving treatments (due to either CHIP or cash).

3. Which of the following is most useful in establishing cause-and-effect relationships?

(A) A complete census

(B) A least squares regression line showing high correlation

(C) A simple random sample (SRS)

(D) A well-designed, well-conducted observational study incorporating chance to ensure a representative sample

(E) A controlled experiment

4. Some medical investigations have indicated that nondrinkers are more likely to develop dementia than drinkers. Assuming these investigations were carefully carried out, what is the most reasonable conclusion?

(A) These were probably observational studies, and so no conclusion about drinking providing protection against dementia is proper.

(B) Given that these investigations were carefully carried out, they probably were experiments. Thus they do show that drinking provides protection against dementia (although it may have other undesired outcomes).

(C) Without information about the use or nonuse of randomization, no conclusion about cause and effect is possible.

(D) Without the use of blinding—for example, having all participants drink something (alcohol or a harmless placebo)—no conclusion is proper.

(E) No matter how carefully the investigations were carried out, no conclusion is possible without knowing the sample sizes.

5. A critical difference between experiments and observational studies is that

(A) experiments are free to choose subjects from an entire population while an observational study considers only a random sample

(B) tests of significance can be used on data collected from experiments but not on data from observational studies

(C) observational studies make use of randomization, while experiments do not

(D) experiments are generally more cost-effective and time-effective than observational studies

(E) an experiment often suggests a causal relationship, while an observational study only suggests an association

6. Which of the following is a true statement?

(A) The purposes behind random sampling and random assignment are different.

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

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

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

(E) Randomized block design refers to deciding randomly which blocks receive which treatments.

7. In which of the following studies are cause-and-effect conclusions (rather than simple association conclusions) probably reasonable?

(A) Studies showing that drivers who speed more than 25 percent above the speed limit have higher mortality rates in accidents than those who do not speed.

(B) Studies showing that college students who regularly use illegal drugs have lower GPAs than students who don't.

(C) Studies showing that teenagers using a particular skin cream tend to have fewer skin problems than teenagers not using that cream.

(D) Studies noting weights and ages at death tend to show that underweight people live longer than overweight people.

(E) Studies noting that children born to parents who are nonsmokers and nondrinkers tend to engage in less risky behavior as adults.

8. Suppose you wish to compare the average age of math/science teachers to the average age of English/social studies teachers 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.

9. Does “an apple a day keep the doctor away?” A study is proposed to pick a random sample of 100 healthy adults, divide them into two groups based on who eats apples regularly and who doesn’t, follow them for five years, and calculate the mean number of doctor visits of each group. Which of the following is a correct statement?

(A) This is an observational study because no treatment is applied.

(B) This is an experiment, but one design fault is that the two groups might be different sizes.

(C) This is an experiment where eating apples is the treatment but there is no control.

(D) This is an experiment, but no causation can be concluded because there was no random assignment.

(E) This is an experiment, but no causation can be concluded because of confounding variables.

10. Personnel entering the armed forces undergo extensive medical testing, and these records are a valuable source of data. Medical researchers compared vitamin D blood level records of military personnel who later developed multiple sclerosis (MS) with the vitamin D blood level records of military personnel who never developed MS. What can be said about this study?

(A) This is an observational study, and the subjects are military personnel. Two variables are considered, vitamin D blood levels and whether or not the subject develops MS.

(B) This is an experiment where the treatments are the different levels of vitamin D in the blood.

(C) This is an experiment where the response variable is whether or not the subject develops MS.

(D) This is an experiment where the subjects who do not develop MS act as a control group.

(E) This is an experiment. However, causation cannot be concluded because there is no random assignment.

11. In a study of medical patches to help prevent the urge to smoke, 500 heavy smokers (at least two packs per day) were randomly sorted into two groups. The smokers in one group were given a new nicotine patch, while smokers in the other group were given a similar-looking patch containing no medication. The subjects did not know who received the drug. In the weeks to follow, all 500 smokers showed a similar reduction in the urge to smoke. This is an example of which of the following?

(A) The effect of a treatment unit

(B) The placebo effect

(C) The control group effect

(D) Sampling error

(E) Voluntary response bias

12. One hundred patients suffering from severe back pain are randomly selected from hospital records. Half the patients are told to listen to classical music and sit in the dark the next time they experience severe pain. The remaining patients are told to use neither of these possible remedies. Participants then report back as to relief, if any. Faults of this experimental design include all of the following except which response?

(A) Lack of randomization

(B) Confounding variables

(C) Lack of blinding

(D) Unclear factor levels

(E) Measurement of response variable

13. Which of the following are most important in minimizing the placebo effect?

(A) Randomization and blinding

(B) Randomization and a control

(C) Replication and randomization

(D) Replication and blinding

(E) Blinding and a control

14. Which of the following is a true statement about blocking?

(A) The paired (matched pairs) comparison design is a special case of blocking.

(B) Blocking is a useful procedure when there are certain attributes, which are not under study, that may affect the outcomes.

(C) Blocking is to experiment design as stratification is to sampling design.

(D) By controlling certain variables, blocking can make conclusions more specific.

(E) All of the above are true statements about blocking.

15. Two procedures are to be compared in the treatment of autism: the use of antipsychotic medication versus family therapy. The experimental design is to create homogeneous blocks with respect to the severity of the developmental disorder. How should randomization be used for a randomized block design?

(A) Within each block, randomly pick half the patients to receive each procedure.

(B) Randomly pick half of all patients to receive each procedure, but then analyze the results separately by blocks.

(C) Randomly choose which blocks will receive which procedure.

(D) Randomly choose half the blocks to receive each procedure for a given time period. Then for the same time period, switch the procedure in each block and compare the results.

(E) For ethical reasons, allow families to choose which procedure they prefer taking, but then randomly assign patients to the blocks.

16. Before playing a soccer game, players rested for 2, 4, or 6 hours. Half of each group was given an energy drink before starting the game. Determine the number of factors, levels for each factor, and number of treatments.

(A) 1 factor with 2 levels; 5 treatments

(B) 2 factors, one with 1 level and one with 2 levels; 3 treatments

(C) 2 factors, one with 2 levels and one with 3 levels; 5 treatments

(D) 2 factors, one with 2 levels and one with 3 levels; 6 treatments

(E) 3 factors, each with 2 levels; 6 treatments

17. A medical researcher is running an experiment on the treatment of carotid artery stenosis with an invasive procedure (stenting or surgery) and a blood thinner (Plavix or aspirin). She has 40 volunteers, half men and half women, all suffering from symptomatic carotid artery stenosis. The researcher randomly selects 10 men and 10 women for treatment with stenting and Plavix, while the remaining volunteers are treated with surgery and aspirin. Of the following, which is the most important observation about this procedure?

(A) The variables—invasive procedure and blood thinner—are confounded.

(B) The variables—gender and invasive procedure—are confounded.

(C) The variables—gender and blood thinner—are confounded.

(D) No variables are confounded.

(E) There is a hidden confounding variable.

18. A sports product agency measures average feet per second for balls hit by high school baseball players using each of four different brand bats (Easton, Louisville Slugger, Rawlings, and DeMarini). 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) Feet per second is the only explanatory variable, but there are four response variables corresponding to the different brands.

(D) There are four levels of a single explanatory variable.

(E) Each explanatory level has an associated level of response.

19. In a random survey of 30 students at an elementary school, those with greater weight appear to have higher math levels. Of the following, which is the most important conclusion about this observation?

(A) Parents interested in their child's math level should feed their children more.

(B) Generalizing from a single elementary school and a single study is unreasonable.

(C) The sample size is too small for any reasonable conclusion.

(D) There is a confounding variable.

(E) As long as the sample was a simple random sample (SRS) from among all students at the school, a cause-and-effect conclusion is valid.

20. A sociologist and musician team wants to estimate the proportion of adults who sing in the shower. They go to a Broadway musical and a Lincoln Center concert and then randomly pick 25 adults from each event to survey. If the team members want to be able to generalize their findings, what are the appropriate sample and population?

(A) The sample is the 50 musical/concert attendees, and the population is all adults.

(B) The sample is the 50 musical/concert attendees, and the population is all adults who attend Broadway musicals or Lincoln Center concerts.

(C) The sample is the 50 musical/concert attendees, and the population is all adults who enjoy music.

(D) The sample is all adults who attend Broadway musicals or Lincoln Center concerts, and the population is all adults.

(E) The sample is all adults who attend Broadway musicals or Lincoln Center concerts, and the population is all adults who enjoy music.

21. Which of the following best explains why researchers try to guard against confounding when designing experiments?

(A) Confounding can conflict with randomization.

(B) Confounding can negate the benefits of blinding.

(C) Confounding can lead to bias.

(D) Confounding can lead to uncertainty as to which variable is causing an effect.

(E) Confounding can make it more difficult to separate subjects into treatment and control groups.

22. A psychologist takes 50 volunteers suffering from acrophobia to the top of the Empire State Building and instructs them to stay there for 12 straight hours in an effort to cure their fear of heights. He contacts them a week later, and 60 percent claim to no longer have a fear of heights. Which of the following is a true statement?

(A) Because the subjects were volunteers, their desire to be cured could be a confounding variable.

(B) With 60 percent claiming a cure after a single treatment, this is statistically significant.

(C) With this large of a sample, $n = 50 \geq 30$, the positive conclusions can be generalized to the general population of people suffering from acrophobia.

(D) Bringing the subjects to the top of the Empire State Building is a treatment, so this is an experiment and positive conclusions are justified.

(E) Because the subjects were volunteers, positive conclusions can be generalized only to other volunteers.

23. A nutritionist conducts a study on serving size. As each attendee arrived at an ice cream social, they were handed either a 12-ounce or an 18-ounce bowl depending upon whether the next digit in a random digit table was odd or even. The nutritionist then noted how much ice cream each attendee put into his or her bowl. All attendees participated. The nutritionist compared the mean helping of ice cream taken by those given 12-ounce bowls versus those given 18-ounce bowls. What method of testing is the nutritionist using?

(A) A census because all attendees participated

(B) An observational study because the nutritionist did not tell anyone how much ice cream to take but, rather, simply observed

(C) An experiment with a blocked design, blocked on size of bowl

(D) An experiment with a completely randomized design

(E) An experiment with a matched-pair design

24. A winemaker is undecided as to which of two grape varieties, A or B, to use in the production of malbec. He runs a test with a random sample of wine connoisseurs. The winemaker randomly assigns each participant to one of four groups and then has taste tests as follows.

	Taste First	Taste Second
Group 1	Variety A, Bottle labeled “10”	Variety B, Bottle labeled “20”
Group 2	Variety B, Bottle labeled “20”	Variety A, Bottle labeled “10”
Group 3	Variety B, Bottle labeled “10”	Variety A, Bottle labeled “20”
Group 4	Variety A, Bottle labeled “20”	Variety B, Bottle labeled “10”

Which of the following explains the use of random assignment here?

(A) The connoisseurs might be partial to whichever wine they taste first. So groups 1 and 4 will first taste the malbec made from grape variety A, while groups 2 and 3 will first taste the malbec made from grape variety B.

(B) The connoisseurs might subconsciously be partial to the bottle labeling, “10” and “20.” So groups 1 and 2 will taste from bottles labeled “10” with variety A grapes and bottles labeled “20” with variety B grapes. Groups 3 and 4 will taste from bottles labeled “10” with variety B grapes and bottles labeled “20” with variety A grapes.

(C) Random assignment in this context is needed to minimize the effect of confounding variables, the most obvious of which are the order of tasting and the labels on the bottles.

(D) All three of the above statements explain the use of random assignment here.

(E) This study is really an observational study, so random assignment does not apply.

25. Twenty volunteers with chronic backache agreed to try yoga exercises for a month, at the end of which 45 percent reported a lower level of back pain. An influential yoga instructor announced on his TV program that yoga exercises are better at relieving back pain than not doing anything. Which of the following best explains why the results of the study do not support the yoga instructor's TV claim?

(A) The subjects were volunteers.

(B) The subjects self-reported pain levels.

(C) The sample was small.

(D) There was no control group.

(E) There was no randomization.

26. A randomized block design will be used in an experiment to test whether or not having alcoholic drinks affects drug effectiveness for people taking different medications. Which of the following relates to the composition of the blocks?

(A) Subjects should be randomly assigned to the blocks.

(B) Subjects in the same block should all receive the same treatment (alcohol or no alcohol).

(C) Subjects in the same block should be as similar as possible (all should be taking the same medication).

(D) Subjects in the same block should be as different as possible (all the medications under study should be represented by subjects in each block).

(E) Participants in each block should be blinded as to which medication they are taking.

27. A high school manager runs a study on whether players can hit a ball farther with an aluminum or a wood bat. For 10 games, as each player comes to bat, the manager reads off the next digit from a random digit table. If the digit is odd, the player uses an aluminum bat. If the digit is even, the player uses a wood bat. What best describes the manager's study?

(A) An observational study

(B) A completely randomized design

(C) A matched-pair design

(D) A randomized block design with two blocks

(E) A flawed experiment because the two types of bat can be confounded

28. What is the purpose of blocking in experimental design?

(A) To control the level of an experiment

(B) To be a first step in randomization

(C) To reduce bias

(D) To reduce variation

(E) To provide a substitute for a control group

29. A botanist tests three different strengths of a new fertilizer on the growth of tomato plants. Which of the following is a true statement?

(A) There are three explanatory variables and one response variable.

(B) There is one explanatory variable with three levels of response variable.

(C) Growth is the only explanatory variable, but there are three response variables corresponding to the three strengths.

(D) There are three levels of a single explanatory variable.

(E) Each explanatory variable has an associated level of response.

30. Which of the following is a true statement about the design of matched pair experiments?

(A) Randomization is unnecessary in matched pair designs.

(B) Blocking is one form of matched pair design.

(C) Each subject might receive both treatments.

(D) Stratification into two equal-sized strata is an example of matched pairs.

(E) Each pair of subjects receives identical treatment, and the differences in their responses are noted.

31. Some researchers believe that drinking a glass of red wine every day can raise the level of HDL, the “good” cholesterol. A study is performed by randomly selecting half of a group of volunteers to drink a glass of red wine every day while the rest are instructed not to drink any red wine. Is this an experiment or an observational study?

(A) An experiment with a single factor

(B) An observational study with comparison and randomization

(C) An experiment with a control group and blinding

(D) An observational study with no bias

(E) An experiment with blocking