

Name _____

Date _____

AP Statistics

Period _____

Unit 5 Review

- 1) Which of the following is not an example of a *probability sample*?
- (a) You are going to sample 10% of a group of students. You randomly select one of the first 10 students on an alphabetical list and then select every 10th student after that on the list.
 - (b) You are a sports-talk radio host interested in opinions about whether or not Pete Rose should be elected to the Baseball Hall of Fame, even though he has admitted to betting on his own teams. You ask listeners to call in and vote.
 - (c) A random sample of drivers is selected to receive a questionnaire about the manners of Department of Motor Vehicle employees.
 - (d) In order to determine attitudes about the Medicare Drug Plan, a random sample is drawn so that each age group (65–70, 70–75, 75–80, 80–85) is represented in proportion to its percentage in the population.
 - (e) In choosing respondents for a survey about a proposed recycling program in a large city, interviewers choose homes to survey based on rolling a die. If the die shows a 1, the house is selected. If the die shows a 2–6, the interviewer moves to the next house.
- 2) Your company has developed a new treatment for acne. You think men and women might react differently to the medication, so you separate them into two groups. Then the men are randomly assigned to two groups and the women are randomly assigned to two groups. One of the two groups is given the medication and the other is given a placebo. The basic design of this study is
- (a) completely randomized
 - (b) blocked by gender
 - (c) completely randomized, blocked by gender
 - (d) randomized, blocked by gender and type of medication
 - (e) a matched pairs design
- 3) Which of the following situations is a cluster sample?
- (a) Survey five friends concerning their opinions of the local hockey team.
 - (b) Take a random sample of five voting precincts in a large metropolitan area and do an exit poll at each voting site.
 - (c) Measure the length of time each fifth person entering a restaurant has to wait to be seated.
 - (d) From a list of all students in your school, randomly select 20 to answer a survey about Internet use.
 - (e) Identify four different ethnic groups at your school. From each group, choose enough respondents so that the final sample contains roughly the same proportion of each group as the school population.

4) Which of the following is true of an experiment but not of an observational study?

- (a) A cause-and-effect relationship can be more easily inferred.
- (b) The cost of conducting it is excessive.
- (c) More advanced statistics are needed for analysis after the data are gathered.
- (d) By law, the subjects need to be informed that they are part of a study.
- (e) Possible confounding variables are more difficult to control.

5) A group of students has 60 houseflies in a large container and needs to assign 20 to each of three groups labeled A, B, and C for an experiment. They can capture the flies one at a time when the flies enter a side chamber in the container that is baited with food. Which of the following methods will be most likely to result in three comparable groups of 20 houseflies each?

- (A) Label the first 20 flies caught as group A, the second 20 caught as group B, and the third 20 caught as group C.
- (B) Write the letters A, B, and C on separate slips of paper. Randomly pick one of the slips of paper and assign the first 20 flies caught to that group. Pick another slip and assign the next 20 flies caught to that group. Assign the remaining flies to the remaining group.
- (C) When each fly is caught, roll a die. If the die shows an even number, the fly is labeled A. If the die shows an odd number, the fly is labeled B. When 20 flies have been labeled A and 20 have been labeled B, the remaining flies are then labeled C.
- (D) Place each fly in its own numbered container (numbered from 1 to 60) in the order that it was caught. Write the numbers from 1 to 60 on slips of paper, put the slips in a jar, and mix them well. Pick 20 numbers out of the jar. Assign the flies in the containers with those numbers to group A. Pick 20 more numbers and assign the flies in the containers with those numbers to group B. Assign the remaining 20 flies to group C.
- (E) When each fly is caught, roll a die. If the die shows a 1 or 2, the fly is labeled A. If the die shows a 3 or 4, the fly is labeled B. If the die shows a 5 or 6, the fly is labeled C. Repeat this process for all 60 flies.

6) A researcher wishes to test a new drug developed to treat hypertension (high blood pressure). A group of 40 hypertensive men and 60 hypertensive women is to be used. The experimenter randomly assigns 20 of the men and 30 of the women to the placebo and assigns the rest to the treatment. The major reason for separate assignment for men and women is that

- (A) it is a large study with 100 subjects
- (B) the new drug may affect men and women differently
- (C) the new drug may affect hypertensive and nonhypertensive people differently
- (D) this design uses matched pairs to detect the new-drug effect
- (E) there must be an equal number of subjects in both the placebo group and the treatment group

7) Jason wants to determine how age and gender are related to political party preference in his town. Voter registration lists are stratified by gender and age-group. Jason selects a simple random sample of 50 men from the 20 to 29 age-group and records their age, gender, and party registration (Democratic, Republican, neither). He also selects an independent simple random sample of 60 women from the 40 to 49 age-group and records the same information. Of the following, which is the most important observation about Jason's plan?

- (A) The plan is well conceived and should serve the intended purpose.
- (B) His samples are too small.
- (C) He should have used equal sample sizes.
- (D) He should have randomly selected the two age groups instead of choosing them nonrandomly.
- (E) He will be unable to tell whether a difference in party affiliation is related to differences in age or to the difference in gender.

8) A study showed that persons who ate two carrots a day had significantly better eyesight than those who ate less than one carrot a week. Which of the following statements is (are) correct?

- I. This study provides evidence that eating carrots contributes to better eyesight.
- II. The general health consciousness of people who eat carrots could be a confounding variable.
- III. This is an observational study and not an experiment.

- (a) I only
- (b) III only
- (c) I and II only
- (d) II and III only
- (e) I, II, and III

9) Which of the following is NOT a characteristic of stratified random sampling?

- (A) Random sampling is part of the sampling procedure.
- (B) The population is divided into groups of units that are similar on some characteristic.
- (C) The strata are based on facts known before the sample is selected.
- (D) Each individual unit in the population belongs to one and only one of the strata.
- (E) Every possible subset of the population, of the desired sample size, has an equal chance of being selected.

10) A new medication has been developed to treat sleep-onset insomnia (difficulty in falling asleep). Researchers want to compare this drug to a drug that has been used in the past by comparing the length of time it takes subjects to fall asleep. Of the following, which is the best method for obtaining this information?

- (A) Have subjects choose which drug they are willing to use, then compare the results.
- (B) Assign the two drugs to the subjects on the basis of their past sleep history without randomization, then compare the results.
- (C) Give the new drug to all subjects on the first night. Give the old drug to all subjects on the second night. Compare the results.
- (D) Randomly assign the subjects to two groups, giving the new drug to one group and no drug to the other group, then compare the results.
- (E) Randomly assign the subjects to two groups, giving the new drug to one group and the old drug to the other group, then compare the results.

11) 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.

12) 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.

13) 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.

14) 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 begin 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 well be a confounding variable responsible for the seeming relationship.
 - III. Self-selection here makes drawing the counselors' conclusion difficult.
- (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.

15) Which of the following are true statements?

- I. Voluntary response samples often underrepresent people with strong opinions.
 - II. Convenience samples often lead to undercoverage bias.
 - III. Questionnaires with nonneutral wording are likely to have response bias.
- (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.

16) Consider the following three events:

- I. Although 18% of the student body are minorities, in a random sample of 20 students, 5 are minorities.
- II. In a survey about sexual habits, an embarrassed student deliberately gives the wrong answers.
- III. A surveyor mistakenly records answers to one question in the wrong space.

Which of the following correctly characterizes the above?

- (A) I, sampling error; II, response bias; III, human mistake
- (B) I, sampling error; II, nonresponse bias; III, hidden error
- (C) I, hidden bias; II, voluntary sample bias; III, sampling error
- (D) I, undercoverage error; II, voluntary error; III, unintentional error
- (E) I, small sample error; II, deliberate error; III, mistaken error

17) 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) 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.

18) 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.

Which of the following is true?

- (A) None of these studies uses randomization.
- (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.
- (E) All of the above

19) In designing an experiment, blocking is used

- (A) to reduce bias.
- (B) to reduce variation.
- (C) as a substitute for a control group.
- (D) as a first step in randomization.
- (E) to control the level of the experiment.

20) A study showed that persons who ate two carrots a day had significantly better eyesight than those who ate less than one carrot a week. Which of the following statements is (are) correct?

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21) Which of the following is true of an experiment but not of an observational study?

- (a) A cause-and-effect relationship can be more easily inferred.
- (b) The cost of conducting it is excessive.
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- (d) By law, the subjects need to be informed that they are part of a study.
- (e) Possible confounding variables are more difficult to control.

22) A *double-blind* design is important in an experiment because

- (a) There is a natural tendency for subjects in an experiment to want to please the researcher.
- (b) It helps control for the placebo effect.
- (c) Evaluators of the responses in a study can influence the outcomes if they know which subjects are in the treatment group and which are in the control group.
- (d) Subjects in a study might react differently if they knew they were receiving an active treatment or a placebo.
- (e) All of the above are reasons why an experiment should be *double-blind*.

23) Data were collected in 20 cities on the percentage of women in the workforce. Data were collected in 1990 and again in 1994. Gains, or losses, in this percentage were the measurement upon which the studies conclusions were to be based. What kind of design was this?

- I. A matched pairs design
 - II. An observational study
 - III. An experiment using a block design
- (a) I only
 - (b) II only
 - (c) III only
 - (d) I and III only
 - (e) I and II only

Part II - Free Response

- 1) A survey of physicians found that some doctors gave a placebo rather than an actual medication to patients who experience pain symptoms for which no physical reason can be found. If the pain symptoms were reduced, the doctors concluded that there was no real physical basis for the complaints. Do the doctors understand *the placebo effect*? Explain.
- 2) A biologist is interested in studying the effect of growth-enhancing nutrients and different salinity (salt) levels in water on the growth of shrimps. The biologist has ordered a large shipment of young tiger shrimps from a supply house for use in the study. The experiment is to be conducted in a laboratory where 10 tiger shrimps are placed randomly into each of 12 similar tanks in a controlled environment. The biologist is planning to use 3 different growth-enhancing nutrients (A, B, and C) and two different salinity levels (low and high).
- (a) List the treatments that the biologist plans to use in this experiment.
- (b) Using the treatments listed in part (a), describe a completely randomized design that will allow the biologist to compare the shrimps' growth after 3 weeks.
- (c) Give one statistical advantage to having only tiger shrimps in the experiment. Explain why this is an advantage.
- (d) Give one statistical disadvantage to having only tiger shrimps in the experiment. Explain why this is a disadvantage.

3) You are going to study the effectiveness of three different SAT preparation courses. You obtain 60 high school juniors as volunteers to participate in your study. You want to assign each of the 60 students, at random, to one of the three programs. Describe a procedure for assigning students to the programs if

- (a) you want there to be an equal number of students taking each course.
- (b) you want each student to be assigned independently to a group. That is, each student should have the same probability of being in any of the three groups.

4) A researcher wants to obtain a sample of 100 teachers who teach in high schools at various economic levels and has access to a list of teachers in several schools for each of the levels. She has identified four such economic levels (A, B, C, and D) that comprise 10%, 15%, 45%, and 30% of the schools in which the teachers work. Describe what is meant by a *stratified random sample* in this situation and discuss how she might obtain it.

5) In 1976, Shere Hite published a book entitled *The Hite Report on Female Sexuality*. The conclusions reported in the book were based on 3000 returned surveys from some 100,000 sent out to, and distributed by, various women's groups. The results were that women were highly critical of men. In what way might the author's findings have been biased?

6) You and nine friends go to a restaurant and check your coats. You all forget to pick up the ticket stubs, and so when you are ready to leave, Hilda, the hat-check girl, randomly gives each of you one of the ten coats. You are surprised that one person actually receives the correct coat. You would like to explore this further and decide to use a random number table to simulate the situation. Describe how the random number table can be used to simulate one trial of the coat episode. Explain what each of the digits 0 through 9 will represent.

7) A high school offers two precalculus courses, one that uses a traditional lecture and drill method, and a second that divides students into small groups to work on open-ended problems. To compare the effectiveness of the two methods, the administration proposes to compare average SAT math scores for the students in the two courses.

- a. What is wrong with the administration's proposal?
- b. Suppose a group of 50 students are willing to take either course. Explain how you would use a random number table to set up an experiment comparing the effectiveness of the two courses.
- c. Apply your setup procedure to the given random number table:

84177 06757 17613 15582 51506 81435 41050 92031 06449
05059 59884 31180 53115 84469 94868 57967 05811 84514
75011 13006 63395 55041 15866 06589 13119 71020 85940
91932 06488 74987 54355 52704 90359 02649 47496 71567
94268 08844 26294 64759 08989 57024 97284 00637 89283
03514 59195 07635 03309 72605 29357 23737 67881 03668
33876 35841 52869 23114 15864 38942

- d. Discuss any lurking variables that your setup doesn't consider.

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