Name: _____

STATISTICS

PART 3 PRACTICE EXAM 2

Time – 1 hour and 30 minutes

Number of multiple choice questions – 20

Number of free response questions - 3

1. 40% of the staff in a local school district have a master's degree. One of the schools in the district has only 4 teachers out of 15 with a master's degree. You are asked to design a simulation to determine the probability of getting this few of teachers with master's degrees in a group of this size. Which of the following assignments of the digits 0 through 9 would be appropriate for modeling this situation?

(A) Assign "0, 1, 2" as having a master's degree and "4, 5, 6, 7, 8, 9" as not having a degree.
(B) Assign "1, 2, 3, 4, 5 " as having a master's degree and "0, 6, 7, 8, 9" as not having a degree.
(C) Assign "0, 1" as having a master's degree and "2, 3, 4, 5, 6, 7, 8, 9" as not having a degree.
(D) Assign "0, 1, 2, 3" as having a master's degree and "4, 5, 6, 7, 8, 9" as not having a degree.
(E) Assign "7, 8, 9" as having a master's degree and "0, 1, 2, 3, 4, 5, 6" as not having a degree.

2. A study showed that persns who ate two carrots a day have significantly better eyesight than those who eat 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

3. You are designing a study to determine which of three brands of golf ball will travel the greatest distance. You intend to use only adult mail golfers. There is evidence to indicate that the temperature at the time of the test affects the distance traveled. There is no evidence that the size of the golfer is related to the distance traveled (distance seems to have more to do with technique than bulk). This experiment would best be done

(A) by blocking on type of golf ball
(B) by blocking on size of golfer
(C) by blocking on size of the golfer and temperature
(D) without blocking
(E) by blocking on temperature

4.

In a certain community, 20% of cable subscribers also subscribe to the company's broadband service for their Internet connection. You would like to design a simulation to estimate the probability that one of six randomly selected subscribers has the broadband service. Using digits 0 through 9, which of the following assignments would be appropriate to model this situation?

(A) Assign even digits to broadband subscribers and odd digits to cable-only subscribers.

(B) Assign 0 and 1 to broadband subscribers and 2, 3, 4, 5, 6, 7, 8, and 9 to cable-only subscribers.

(C) Assign 0, 1, and 2 to broadband subscribers and 3, 4, 5, 6, 7, 8, and 9 to a cable-only subscribers.

(D) Assign 1, 2, 3, 4, 5, and 6 to broadband subscribers and 7, 8, 9, and 0 to cable-only subscribers.

(E) Assign 0, 1, and 2 to broadband subscribers; 3, 4, 5, and 6 to cable-only subscribers; and ignore digits 7, 8, and 9.

5.

A cause-and-effect relationship between two variables can best be determined from which of the following?

(A) A survey conducted using a simple random sample of individuals

(B) A survey conducted using a stratified random sample of individuals

(C) An association with a correlation coefficient near 1 or -1

(D) An observational study where the observational units are chosen randomly

(E) A controlled experiment where the observational units are assigned randomly

6.

Which of the following is a true statement about experimental design?

(A) Replication is a key component in experimental design. Thus, an experiment needs to be conducted on repeated *samples* before generalizing results.

(B) Control is a key component in experimental design. Thus, a control group that receives a placebo is a *requirement* for experimentation.

(C) Randomization is a key component in experimental design. Randomization is used to *reduce* bias.

(D) Blocking eliminates the effects of *all* lurking variables.

(E) The placebo effect is a concern for *all* experiments.

7.

An experimenter believes that two new exercise programs are more effective than any current exercise routines and wishes to compare the effectiveness of these two new exercise programs on physical fitness. The experimenter is trying to determine whether or not a control group, which follows neither of these new programs but continues with current exercise routines, would be beneficial. Which of the following can be said about the addition of a control group?

(A) A control group would eliminate the placebo effect.

(B) A control group would eliminate the need for blinding in the study.

(C) A control group would allow the experimenter to determine which of the two exercise programs improves physical fitness the most.

(D) A control group would allow the experimenter to determine if either of the exercise programs is more effective than current programs for physical fitness.

(E) There would be no added benefit to having a control group.

8.

Which of the following sample designs does *not* contain a source of bias?

(A) A politician would like to know how her constituents feel about a particular issue. As a result, her office mails questionnaires about the issue to a random sample of adults in her political district.

(B) A company uses the telephone directory to randomly select adults for a telephone survey to gauge their feelings toward items manufactured by the company.

(C) An interviewer selects a random sample of individuals to question about a particular issue. Since some of the individuals are not informed about the issue, the interviewer gives background and his personal view on the issue before recording their responses.

(D) A news show asks viewers to call a toll-free number to express their opinions about a recent high-publicity trial.

(E) One thousand numbered tickets are sold as a fund-raiser. Five numbers are chosen randomly, and the individuals with the winning ticket numbers each win $10.

9.

A university is proposing a new procedure for professors to gain tenure. To gauge sentiment about the proposal, the university intends to randomly sample five professors, five assistant professors, five associate professors, five adjunct professors, and five visiting professors. This is an example of what type of sampling design?

(A) Simple random sample

(B) Stratified random sample

(C) Systematic random sample

(D) Cluster sample

(E) Convenience sample

10.

A drug company wishes to test a new drug. A researcher assembles a group of volunteers and randomly assigns them to one of two groups—one to take the drug and one to take a placebo. In addition, the company wants the experiment to be double-blind. What is the meaning of double-blind in this situation?

(A) The volunteers in both groups are blindfolded when they take the drug or placebo.

(B) The volunteers in both groups do not know whether they are taking the drug or the placebo.

(C) Neither the volunteers nor the drug company executives know which volunteers are taking the drug and which are taking the placebo.

(D) Neither the volunteers nor the evaluator know which volunteers are taking the drug and which are taking the placebo.

(E) As long as the subjects are randomly assigned to the two groups, there is no need to make the experiment double-blind.

11.

Since many individuals walk around their homes in their socks, a manufacturer has created a material for socks that is believed to be more resistant to wear than cotton. The manufacturer wishes to test this belief over a period of a month. Given a group of volunteers, which of the following designs will *best* test this new material's resistance to wear?

(A) Have the volunteers wear the socks made from the new material for a month, and check the wear on the socks at the end of the month.

(B) Allow half of the volunteers to wear cotton socks, while the other half wear socks made of the new material. Compare the wear on the socks at the end of the month.

(C) Randomly assign half of the volunteers to wear cotton socks, while the other half wear socks made of the new material. Compare the wear on the socks at the end of the month.

(D) Randomly assign half of the volunteers to wear cotton socks, while the other half wear socks made of the new material. At the end of two weeks, the volunteers should change sock types. Compare the wear on the socks at the end of the month.

(E) For each volunteer, randomly choose which foot wears a cotton sock, while the other foot wears a sock made of the new material. Compare the wear on the socks at the end of the month.

12.

Having read about the positive effects of gingko biloba on memory, some precocious statistics students decide to conduct their own experiment to test the herb's effects. Close to 50 of their classmates, all in good health and representing a variety of ethnic groups, volunteer to take part in the experiment, and the students randomly assign half of the volunteers to take gingko. The other half take a placebo. The students perform a memory test on the volunteers at the beginning of the experiment and a second test eight weeks later. After analyzing their results, they find no memory improvement in the gingko group versus the placebo group. Assuming the students followed all aspects of good experimental design, which of the following can be concluded?

(A) Gingko biloba does not improve memory, and no one should take it to improve memory.

(B) Gingko biloba does not improve memory in healthy individuals and should only be taken by individuals exhibiting signs of dementia.

(C) Gingko biloba does not improve memory in healthy teenagers and should only be taken by adults.

(D) Gingko biloba does not improve memory in healthy teenagers and should only be taken by adults in poor health.

(E) Gingko biloba does not improve memory in healthy teenagers, and further studies should be conducted to determine its effectiveness in other groups.

13.

In order to ease parking problems in a community containing a university, university officials propose purchasing one acre of community parkland that is adjacent to the university to build a parking garage. The officials believe community members will overwhelmingly support this proposal, and they would like to conduct a survey of 100 community members to confirm their belief. Which of the following will produce a simple random sample?

(A) Recording the opinion of the first 100 people who call the university regarding this issue

(B) Randomly selecting 100 people from the local phone directory

(C) Surveying every third person who walks past the administrative offices until 100 people have responded

(D) Using the latest census data from the community, numbering the residents, and using a random-number table to choose 100 people

(E) Using the latest census data from the community and randomly choosing 25 residents ages 18–25, 25 residents ages 26–39, 25 residents ages 40–64, and 25 residents ages 65 and over

14.

Which of the following statements is true?

(A) A census is an experiment that involves the entire population.

(B) A parameter is a value used to describe a sample.

(C) A sample is the entire group of individuals we want information about.

(D) In stratified random sampling, every individual has the same probability of being chosen.

(E) Voluntary samples never introduce bias.

15.

A study was conducted to determine the benefit of an over-the-counter medication in reducing the development of disease. Subjects selected were chosen because they were known to be in a high-risk group for the disease. The results of the study are

(A) not replicable.

(B) applicable only to the subjects in the study.

(C) not readily generalizable.

(D) false and misleading.

(E) valid for all takers of this over-the-counter medication.

16.

Patients afflicted with a debilitating disease took part in a study to measure the effectiveness of a new drug in controlling the progress of the disease. The patients were divided into two groups: an experimental group who received the drug and a control group who received a placebo. The results of the experimental group were so positive that the study was stopped early. This was most likely because

(A) the researchers stopped getting useful information.

(B) the researchers realized that their subjects were poorly chosen.

(C) the researchers felt that it was too expensive to continue the study.

(D) the researchers felt it was unethical to use only patients who had the disease in the study.

(E) the researchers felt it was unethical to withhold an effective treatment from the placebo group.

17.

A study randomly assigned patients to treatment groups to determine the effect of taking aspirin in preventing the development of colon polyps. One group took an aspirin daily, and the other group took a placebo. Neither the patients nor the doctors knew who was getting which pill. This study is best described as a

(A) block design with random assignment.
(B) double-blind comparative experiment.
(C) blinded block design observational study.
(D) blind experiment with random assignment.
(E) randomly assigned observational study.

18.

If you wanted to find the average GPA for seniors at your school who have been accepted into college, what would be the most appropriate technique to use to gather the data?

(A) Census
(B) Simple random sample
(C) Stratified random sample
(D) Systematic random sample
(E) Controlled experiment

19.

Two students went to their local shopping mall to conduct a survey. They wanted to know how the local population felt about boys coloring their hair. Both students had neat haircuts but one had dyed hair and one did not. What type of bias could occur in their survey?

(A) Undercoverage
(B) Nonresponse bias
(C) Response bias
(D) None of the above
(E) A, B, and C may produce bias in this setting.

FREE RESPONSE

Questions 1-3

Spend about 45 minutes on this part of the exam.

2003 Form A Question 4

1.

Because of concerns about employee stress, a large company is conducting a study to compare two programs (tai chi or yoga) that may help employees reduce their stress levels. Tai chi is a 1,200-year-old practice, originating in China, that consists of slow, fluid movements. Yoga is a practice, originating in India, that consists of breathing exercises and movements designed to stretch and relax muscles. The company has assembled a group of volunteer employees to participate in the study during the first half of their lunch hour each day for a 10-week period. Each volunteer will be assigned at random to one of the two programs. Volunteers will have their stress levels measured just before beginning the program and 10 weeks later at the completion of it.

(a) A group of volunteers who work together ask to be assigned to the same program so that they can participate in that program together. Give an example of a problem that might arise if this is permitted. Explain to this volunteer group why random assignment to the two programs will address this problem.

(b) Someone proposes that a control group be included in the design as well. The stress level would be measured for each volunteer assigned to the control group at the start of the study and again 10 weeks later. What additional information, if any, would this provide about the effectiveness of the two programs?

(c) Is it reasonable to generalize the findings of this study to all employees of this company? Explain.

2002 Form B Question 3

2.

A preliminary study conducted at a medical center in St. Louis has shown that treatment with small, low-intensity magnets reduces the self-reported level of pain in polio patients. During each session, a patient rested on an examining table in the doctor's office while the magnets, embedded in soft pads, were strapped to the body at the site of pain. Sessions continued for several weeks, after which pain reduction was measured.

A new study is being designed to investigate whether magnets also reduce pain in patients suffering from herniated disks in the lower back. One hundred male patients are available for the new study.

(a) Describe an appropriate design for the new study. Your discussion should briefly address treatments used, methods of treatment assignment, and what variables would be measured. Do not describe how the data would be analyzed.

(b) Would you modify the design above if, instead of 100 male patients, there were 50 male and 50 female patients available for the study? If so, how would you modify your design? If not, why not?

2002 Form A Question 2

3.

A manufacturer of boots plans to conduct an experiment to compare a new method of waterproofing to the current method. The appearance of the boots is not changed by either method. The company recruits 100 volunteers in Seattle, where it rains frequently, to wear the boots as they normally would for 6 months. At the end of the 6 months, the boots will be returned to the company to be evaluated for water damage.

(a) Describe a design for this experiment that uses the 100 volunteers. Include a few sentences on how it would be implemented.

(b) Could your design be double blind? Explain.