Review Questions and Answers

Multiple Choice Questions

Directions: Solve each of the following problems. Decide which is the best of the choices given.

1. You are designing an experiment to test the effectiveness of two new medications. You randomly assign 240 subjects to one of three groups. One of the groups is given a placebo, and the other two groups each receive one of the two new medications. Neither the subjects nor the researchers know into which group each subject is placed. This represents what kind of experimental design?

    A. A double-blind three block design
    B. A double-blind matched pairs with control group design
    C. A block design with randomization
    D. A completely randomized design
    E. A control block design

2. You are designing an experiment to test the effectiveness of two new medications. You know that males and females respond differently to the medications. You randomly assign the 120 male subjects to one of three groups. One group is given a placebo, and the other two groups each receive one of the two medications. You randomly assign the 120 female subjects to one of three groups. One group is given a placebo, and the other two groups each receive one of the two medications. Neither the subjects nor the researchers know into which group each subject is placed. This represents what kind of experimental design?

    A. A double-blind three block design
    B. A double-blind matched pairs with control group design
    C. A block design with randomization
    D. A completely randomized design
    E. A control block design

3. The manufacturer of a new toothpaste claims that the new product helps whiten teeth. Sixty subjects were randomly selected and had the whiteness of their teeth measured during an examination. Each subject used the new toothpaste for four months. The whiteness of their teeth was again measured, and the results of the two measurements were compared. Which of the following is true?

    A. This is not an experiment since no control group was used.
    B. This is not an experiment since the study was not blind.
    C. This is an experiment using a matched pair design with each subject acting as their own control.
    D. This is an experiment using a completely randomized design.
    E. This is an observational study using a completely randomized design.

4. Which of the following is the best description of replication?

    A. Asking subjects the same question in different ways
    B. A technique of increasing the number of treatments used in an experiment
    C. A technique of increasing the number of subjects in an experiment to help decrease variation caused by chance
    D. A tendency for subjects to be influenced by knowing what group they are in
    E. A technique of distributing subjects into random groups

5. You are designing an experiment with one treatment and one control group. You are blocking for two different variables, gender (M, F) and blood type (A, B, AB, O). If you want each group to contain 20 subjects, what is the total number of subjects needed for the experiment?

A. 120

B. 160

C. 240

D. 320

E. None of the above

6. In the design of experiments, _____ is used to control known variables, and _____ is used to control unknown variables.

A. Blinding, randomization

B. Pairing, blocking

C. Randomization, blocking

D. Blocking, randomization

E. Randomization, pairing

7. Before and after experiments, those that use the same subjects for pre-testing and post-testing a treatment, use what type of design?

A. Double-blind design

B. Blocking with control design

C. Completely randomized design

D. Blocking without control design

E. Matched pair design

8. Which of the following are true statements?

I. All blocking techniques involve matched pair design.

II. When using matched pair design, subjects may be their own control.

III. In a matched pair design, all subjects may receive the same two treatments but in a random order.

A. II only

B. I and II

C. I and III

D. II and III

E. I, II, and III

9. Which of the following represents a tendency for subjects to respond well to any treatment?

A. Placebo effect

B. Blocking

C. Blinding

D. Matched-pairs

E. Replication

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10. In experimental design, which of the following should be used to deal with unknown variables?

   I.   Randomization
  II. Replication
 III. Control

   A. III only
   B. I and II
   C. I and III
   D. II and III
   E. I, II, and III

11. You are designing a study to test the effectiveness of a new medication. Blood type is known to have been a confounding variable in the past, so you divide the subjects by blood type. For each blood type, you randomly assign subjects to either a treatment group or a control group. The subjects do not know to which group they have been assigned. Which of the following describes this experimental design?

   A. Complete randomization, blinding, blocking
   B. Stratification, randomization, blinding
   C. Blocking for control, blinding, randomization
   D. Matched pair, blinding, randomization
   E. Systematic selection, blinding, control for blood type

12. Twelve subjects are given a pre-test. They are then provided with materials to help improve their test scores. Subjects then are given a post-test, and the scores of each subject are compared. Which experimental design does this represent?

   A. Blocking
   B. Double-blind
   C. Matched pairs
   D. Replication
   E. Randomization

13. There are 80 used cars on a lot at a local dealership. Which of the following procedures will yield a simple random sample of 20 of these cars?

   A. Select the 20 cars parked closest to the office.
   B. Write down the license numbers of all 80 cars in a list. Randomly select one of the first four cars on the list. Select every fourth car thereafter from the list.
   C. Write down the license numbers of all 80 cars in a list. Divide the list into 20 groups of four each. Randomly select one car from each group.
   D. Write down the license number of all 80 cars on 3 × 5 cards, one per card. Shuffle the deck of cards several times. Select the fourth card in the deck. Shuffle the cards again. Select the fourth card in the deck. Repeat until 20 cars have been chosen.
   E. Write down the license numbers of all 80 cars in a list. Divide the list into two groups of 40 each. Randomly select 10 cars from each group.

14. An experiment is being designed to determine the effectiveness of three different cat food supplements. Since data existed for diets without supplements, no control was used in the experiment. The researcher has decided to block for three different species of cat and also for gender. How many groups of cats will be needed for the experiment?

   A. 8
   B. 10
   C. 12
   D. 18
   E. 24

Free-Response Questions

Directions: Show all work. Indicate clearly the methods you use. You will be graded on method as well as accuracy.

1. A researcher randomly selected a group of 200 students who had taken both an algebra class and a statistics class in college. Each of these students was asked which class they liked better. Of the 200 students, 99 said they liked statistics better and 101 students said they liked algebra better. Based on these results, the researcher concluded that neither class stood out as a favorite. Was this an experiment or an observation study? Was there a possible confounding variable? If so, what might it be?

2. A bar owner offers his customers free nuts, which are in bowls on all of the tables. He has two different types of nuts. The two varieties look and taste the same, but one variety has a much higher potassium content than the other. The bar owner would like to determine whether serving the variety with added potassium, which costs more than the other variety, will get the customers to order more drinks. Design an experiment to test the two nut varieties.

3. Many years ago, some physicians dispensed medication directly to their patients. One dishonest doctor gave out sugar pills instead of real medication to some of his patients to save money. Many of the patients who received these sugar pills actually had their symptoms vanish, and they felt better even without getting the real medication. Explain how this can happen.

4. Twenty-four containers, arranged in four rows of six containers each, are on a counter near a window. The rows are parallel to the window. Twenty-four plants, 8 each of 3 varieties, will be grown to test a new fertilizer. You want to feed half of the plants the new fertilizer (treatment group) and half the old fertilizer (control group). You are concerned that proximity to the window might be a confounding variable. Design a procedure for determining how to select which plants should be placed in each container and which ones receive each treatment.

5. Use a completely randomized design to construct an experiment that studies whether taking a garlic supplement in tablet form can reduce the occurrence of colds during the winter.

6. An experiment to test the effectiveness of four different medications is being designed. Four hundred subjects have volunteered to participate. Construct a procedure to randomly select subjects so that each subject will be assigned to one of the four treatment groups. It is more important that each subject has the same chance of being assigned to each treatment group than it is to have equal-sized treatment groups.

7. As a restaurant owner, you are interested in determining whether people who order a drink before dinner spend more on their meal (excluding the drinks) than people who do not order a drink. Over a period of two weeks, you record data on 320 customers who ordered drinks before their meals and 460 customers who did not order a drink before their meals. After tabulating the results, you find that the drinkers spent considerably more than the non-drinkers. Is this an experiment or an observational study? Explain.

8. Subjects in an experiment have been selected to receive one of two different treatments or a placebo. Two different measurements are periodically taken with respect to each subject, one of which is objective and one is subjective. Discuss why this experiment should be double-blind.

9. A researcher wants to determine whether performance in statistics classes can be influenced by the expectation of success. A statistics teacher will be teaching 15 sections of statistics over a two-year period. He wants to tell the students in some sections that "females perform better in statistics than males." In some other sections he wants to say "males perform better in statistics than females." Design an experiment that uses treatment groups and control groups and blocks for the difference between day and evening sections.