

**Multiple Choice (1 pt. each)**

1. A manufacturer of ready-bake cake mixes is interested in designing a study to test the effects of 4 different temperature levels (300, 325, 350, and 375 degrees F), 2 different types of pans (glass and metal) and 3 different types of ovens (gas, electric, and microwave) on the texture of its cakes. How many different treatment combinations are to be used in this study?

- (a) 3            (b) 9            (c) 18            (d) 20            (e) 24

2. A university is proposing a new procedure for professors to gain tenure. It 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

3. In a clinic, 50 patients with sleep disorders are randomly assigned to one of two different groups. Patients in one group are given medication before bedtime. Patients in the other group are given blindfolds and played soft music at bedtime. Each patient is attached to a machine that records breathing patterns. From the patterns, it is possible to determine if the patient is awake or asleep. The data will be used to decide which method is more effective in helping patients with sleep disorders. Which of the following statements is correct in the context of this experiment?

- (a) This is a single blind experiment, because only one group uses blindfolds.  
(b) This is a single blind experiment, because only patients and not doctors use blindfolds.  
(c) This is a double blind experiment, since patients are blindfolded and the doctor does not know which patient receives which treatment.  
(d) This experiment cannot be a single blind experiment, because many patients do not like to be blindfolded.  
(e) This experiment cannot be a double blind experiment, because patients will know which treatment they are receiving, although the examining doctor might not.

4. An experiment was designed to test the effects of 3 different types of paint on the durability of wooden toys. Since boys and girls tend to play differently with toys, a randomly selected group of children was divided into 2 groups by gender. Which of the following statements is true?

- (a) There are 3 types of paint and 2 gender groups, giving a total of 5 treatment variables in this experiment.
- (b) Type of paint is a blocking factor.
- (c) Gender is a blocking variable.
- (d) This is a completely randomized design.
- (e) This is a matched-pairs design in which one boy and one girl are matched by age to form a pair.

5. An insurance agent is successful in selling a life insurance policy to 20 percent of the customers he contacts. He decides to construct a simulation to estimate the mean number of customers he needs to contact before being able to sell a policy. Which of the following schemes should he use to do the simulation?

- (a) Assign numbers "0, 1" to successfully selling a policy to a customer and numbers "2, 3, 4, 5, 6, 7, 8, 9" to failing to sell a policy to a customer.
- (b) Assign numbers "0, 1" to successfully selling a policy to a customer and numbers "2, 3, 4" to failing to sell a policy to a customer.
- (c) Assign number "0" to successfully selling a policy to a customer and numbers "0, 1" to failing to sell a policy to a customer.
- (d) Assign numbers "0, 1, 2, 3, 4" to successfully selling a policy to a customer and numbers "5, 6, 7, 8, 9" to failing to sell a policy to a customer.
- (e) Assign number "20" to successfully selling a policy to a customer and numbers "1, 3, 5, 7, 9, 11, 13, 15, 17, 19" to failing to sell a policy to a customer.

6. In one study on the effect that eating meat products has on weight level, an SRS of 500 subjects who admitted to eating meat at least once a day had their weights compared with those of an independent SRS of 500 people who claimed to be vegetarians. In a second study, an SRS of 500 subjects were served at least one meat meal per day for 6 months, while an independent SRS of 500 others were chosen to receive a strictly vegetarian diet for 6 months, with weights compared after 6 months.

- (a) The first study is a controlled experiment, while the second is an observational study.
- (b) The first study is an observational study, while the second is a controlled experiment.
- (c) Both studies are controlled experiments.
- (d) Both studies are observational studies.
- (e) Each study is part controlled experiment and part observational study.

7. Two possible wordings for a questionnaire on gun control are as follows:

- I. The United States has the highest rate of murder by handguns among all countries. Most of these murders are known to be crimes of passion or crimes provoked by anger between acquaintances. Are you in favor of a 7-day cooling-off period between the filing of an application to purchase a handgun and the resulting sale?
- II. The United States has the highest rate of murder by handguns among all countries. Most people want to keep handguns in their homes for self-protection. Fortunately, U.S. Citizens are guaranteed the right to bear arms by the Constitution. Are you in favor of a 7-day cooling-off period between the filing of an application to purchase a handgun and the resulting sale?

One of these questions showed that 25% of the population favored a 7-day waiting period between application for purchase of a handgun and the resulting sale, while the other question showed that 70% of the population favored the waiting period. Which produced which result and why?

- (a) The first question probably showed 70% and the second question 25% because the lack of randomization in the choice of pro-gun and anti-gun subjects as evidenced by the wording of the questions.
- (b) The first question probably showed 25% and the second question 70% because of a placebo effect due to the wording of the questions.
- (c) The first question probably showed 70% and the second question 25% because the lack of a control group.
- (d) The first question probably showed 25% and the second question 70% because of response bias due to the wording of the questions.
- (e) The first question probably showed 70% and the second question 25% because of response bias due to the wording of the questions.

8. Which of the following are true statements about blocking?

- 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
- (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 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 should they expect to occur in their survey?

- (a) Undercoverage
- (b) Non-Response Bias
- (c) Response Bias
- (d) None of the above
- (e) A, B, and C produce bias in this setting

10. 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.

**Free Response (4 pts. each)**

1. (2003 Q4) 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 1200 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 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 of 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.

2. (2005 Q5) A survey will be conducted to examine the educational level of adult heads of households in the United States. Each respondent in the survey will be placed into one of the following two categories:

- Does not have a high school diploma
- Has a high school diploma

The survey will be conducted using a telephone interview. Random-digit dialing will be used to select that sample.

- (a) For this survey, state one potential source of bias and describe how it might affect the estimate of the proportion of adult heads of households in the United States who do not have a high school diploma.
- (b) Since education is largely the responsibility of each state, the agency wants to be sure that estimates are available for each state as well as for the nation. Identify a sampling method that will achieve this additional goal and briefly describe a way to select the survey sample using this method.