

Chapter 4 Practice Test

T4.1. When we take a census, we attempt to collect data from

- (a) a stratified random sample.
- (b) every individual chosen in a simple random sample.
- (c) every individual in the population.**
- (d) a voluntary response sample.
- (e) a convenience sample.

T4.2. You want to take a simple random sample (SRS) of 50 of the 816 students who live in a dormitory on campus. You label the students 001 to 816 in alphabetical order. In the table of random digits, you read the entries

~~95592~~ ~~94007~~ ~~69769~~ ~~33547~~ 72450 16632 81194 14873

ignore #'s larger than 816 and repeats, etc

The first three students in your sample have labels

- (a) ~~955, 929, 400.~~
- (b) 400, 769, 769.
- (c) ~~559, 294, 007.~~
- (d) ~~929, 400, 769.~~
- (e) 400, 769, 335.**

400, 769, 335

T4.3. A study of treatments for angina (pain due to low blood supply to the heart) compared bypass surgery, angioplasty, and use of drugs. The study looked at the medical records of thousands of angina patients whose doctors had chosen one of these treatments. It found that the average survival time of patients given drugs was the highest. What do you conclude?

- ~~(a) This study proves that drugs prolong life and should be the treatment of choice.~~
- ~~(b) We can conclude that drugs prolong life because the study was a comparative experiment.~~
- ~~(c) We can't conclude that drugs prolong life because the patients were volunteers.~~
- (d) We can't conclude that drugs prolong life because this was an observational study.**
- ~~(e) We can't conclude that drugs prolong life because no placebo was used.~~

In order to infer cause and effect, we must run a well designed experiment. This was an observational study.

T4.4. A simple random sample (SRS) is

- (a) any sample selected by using chance.
- (b) any sample that gives every individual the same chance to be selected.
- (c) a sample that gives every possible sample of the same size the same chance to be selected.**
- (d) a sample that doesn't involve strata or clusters.
- (e) a sample that is guaranteed to be representative of the population.

(compared) medical records)

This is definition of SRS

T4.5. Consider an experiment to investigate the effectiveness of different insecticides in controlling pests and their impact on the productivity of tomato plants. What is the best reason for randomly assigning treatment levels (spraying or not spraying) to the experimental units (farms)?

- (a) Random assignment makes the experiment easier to conduct since we can apply the insecticide in any pattern rather than in a systematic fashion.
- (b) Random assignment will tend to average out all other uncontrolled factors such as soil fertility so that they are not confounded with the treatment effects.**
- (c) Random assignment makes the analysis easier since the data can be collected and entered into the computer in any order.
- (d) Random assignment is required by statistical consultants before they will help you analyze the experiment.
- (e) Random assignment implies that it is not necessary to be careful during the experiment, during data collection, and during data analysis.

** By randomly assigning treatments we are attempting to make the different groups look similar as possible so that we can reduce the likelihood of a confounding variable.*

T4.6. The most important advantage of experiments over observational studies is that

- (a) experiments are usually easier to carry out.
- (b) experiments can give better evidence of causation.
- (c) confounding cannot happen in experiments.
- (d) an observational study cannot have a response variable.
- (e) observational studies cannot use random samples.

only use observational studies when lack of realism can limit our ability to apply conclusions of an experiment to the settings of greatest interest

T4.7. A TV station wishes to obtain information on the TV viewing habits in its market area. The market area contains one city of population 170,000, another city of 70,000, and four towns of about 5000 inhabitants each. The station suspects that the viewing habits may be different in larger and smaller cities and in the rural areas.

Which of the following sampling designs would give the type of information that the station requires?

- (a) A cluster sample using the cities and towns as clusters
- (b) A convenience sample from the market area
- (c) A simple random sample from the whole market area
- (d) A stratified sample from the cities and towns in the market area
- (e) An online poll that invites all people from the cities and towns in the market area to participate

*Similar within, different between groups
By stratifying we can control how many people we survey in each of the different kinds of areas.*

T4.8. Bias in a sampling method is

- (a) any error in the sample result, that is, any deviation of the sample result from the truth about the population.
- ~~(b) the random error due to using chance to select a sample.~~
- (c) any error due to practical difficulties such as contacting the subjects selected.
- (d) any systematic error that tends to occur in the same direction whenever you use this sampling method.
- ~~(e) racism or sexism on the part of those who take the sample.~~

response bias

T4.9. You wonder if TV ads are more effective when they are longer or repeated more often or both. So you design an experiment. You prepare 30-second and 60-second ads for a camera. Your subjects all watch the same TV program, but you assign them at random to four groups. One group sees the 30-second ad once during the program; another sees it three times; the third group sees the 60-second ad once; and the last group sees the 60-second ad three times. You ask all subjects how likely they are to buy the camera.

- (a) This is a randomized block design, but not a matched pairs design.
- (b) This is a matched pairs design.
- (c) This is a completely randomized design with one explanatory variable (factor).
- (d) This is a completely randomized design with two explanatory variables (factors).
- (e) This is a completely randomized design with four explanatory variables (factors).

T4.10. A researcher wishes to compare the effects of 2 fertilizers on the yield of soybeans. She has 20 plots of land available for the experiment, and she decides to use a matched pairs design with 10 pairs of plots. To carry out the random assignment for this design, the researcher should

- (a) use a table of random numbers to divide the 20 plots into 10 pairs and then, for each pair, flip a coin to assign the fertilizers to the 2 plots.
- (b) subjectively divide the 20 plots into 10 pairs (making the plots within a pair as similar as possible) and then, for each pair, flip a coin to assign the fertilizers to the 2 plots.
- (c) use a table of random numbers to divide the 20 plots into 10 pairs and then use the table of random numbers a second time to decide upon the fertilizer to be applied to each member of the pair.
- (d) flip a coin to divide the 20 plots into 10 pairs and then, for each pair, use a table of random numbers to assign the fertilizers to the 2 plots.
- (e) use a table of random numbers to assign the 2 fertilizers to the 20 plots and then use the table of random numbers a second time to place the plots into 10 pairs.

In a matched pairs design, the two subjects in the pair should be as similar as possible, so use a subjective method for pairing the plots. Once pairs are chosen, flip coin to randomly assign treatments to the 2 plots in the pair.

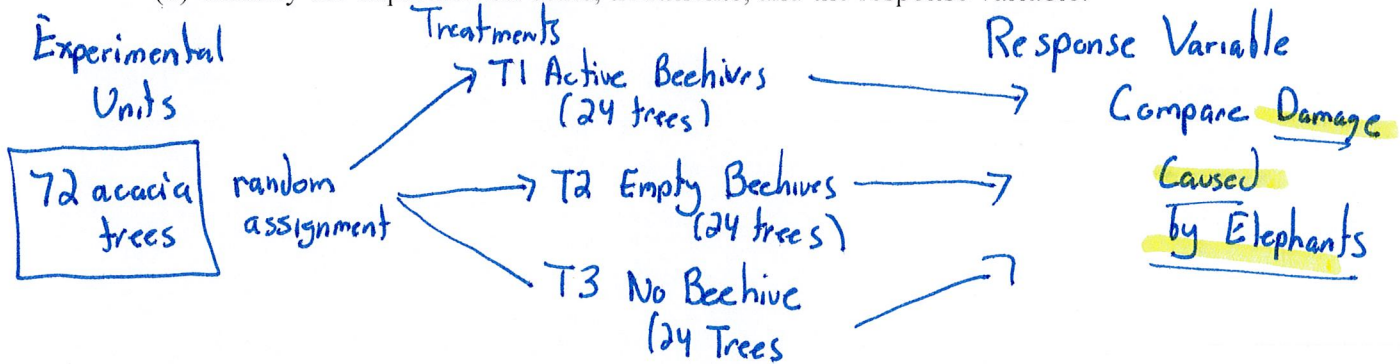
T4.11. You want to know the opinions of American high school teachers on the issue of establishing a national proficiency test as a prerequisite for graduation from high school. You obtain a list of all high school teachers belonging to the National Education Association (the country's largest teachers' union) and mail a survey to a random sample of 2500 teachers. In all, 1347 of the teachers return the survey. Of those who responded, 32% say that they favor some kind of national proficiency test. Which of the following statements about this situation is true?

- (a) Since random sampling was used, we can feel confident that the percent of all American high school teachers who would say they favor a national proficiency test is close to 32%.
- (b) We cannot trust these results, because the survey was mailed. Only survey results from face-to-face interviews are considered valid.
- (c) Because over half of those who were mailed the survey actually responded, we can feel pretty confident that the actual percent of all American high school teachers who would say they favor a national proficiency test is close to 32%.
- (d) The results of this survey may be affected by nonresponse bias.
- (e) The results of this survey cannot be trusted due to voluntary response bias.

Section II: Free Response *Show all your work. Indicate clearly the methods you use, because you will be graded on the correctness of your methods as well as on the accuracy and completeness of your results and explanations.*

T4.12. Elephants sometimes damage trees in Africa. It turns out that elephants dislike bees. They recognize beehives in areas where they are common and avoid them. Can this be used to keep elephants away from trees? A group in Kenya placed active beehives in some trees and empty beehives in others. Will elephant damage be less in trees with hives? Will even empty hives keep elephants away? Researchers want to design an experiment to answer these questions using 72 acacia trees.⁶⁴

(a) Identify the experimental units, treatments, and the response variable.



(b) Describe how the researchers could carry out a completely randomized design for this experiment. Include a description of how the treatments should be assigned.

Completely Randomized Design

① Randomly assign The acacia trees to the 3 treatments. Each treatment will be assigned 24 trees.

② You can use hat method, technology, or random table. Assign each tree a number from 1-72. Write the #'s 1-72 on slips of paper (same size) and place in a hat. Mix well! Draw the 1st 24 #'s and assign these trees to Treatment 1. The next 24 #'s drawn assign to treatment 2, and then assign the remaining 24 trees to Treatment 3.

③ At the end, compare the damages caused by elephants to the trees with active beehives, empty beehives, and no beehives.

T4.13. A 2008 *New York Times* article on public opinion about steroid use in baseball discussed the results of a sample survey. The survey found that 34% of adults think that at least half of Major League Baseball (MLB) players "use steroids to enhance their athletic performance." Another 36% thought that about a quarter of MLB players use steroids; 8% had no opinion. Here is part of the *Times*'s statement on "How the Poll Was Conducted":

The latest New York Times/CBS News Poll is based on telephone interviews conducted March 15 through March 18 with 1,067 adults throughout the United States.... The sample of telephone numbers called was randomly selected by a computer from a list of more than 42,000 active residential exchanges across the country. The exchanges were chosen to ensure that each region of the country was represented in proportion to its population. In each exchange, random digits were added to form a complete telephone number, thus permitting access to listed and unlisted numbers. In each household, one adult was designated by a random procedure to be the respondent for the survey.⁶⁵

- (a) Explain why the sampling method used in this survey was *not* a simple random sample.

This is not a SRS b/c not all samples were possible. For example, given their method, they could not have all respondents from the East Coast.

- (b) Why was one adult chosen at random in each household to respond to the survey?

One adult was chosen at random to control for lurking variables. Perhaps household members who generally answer the phone have a different opinion from those who don't generally answer the phone.

- (c) Explain how undercoverage could lead to bias in this sample survey.

There was undercoverage in this survey. Those who do not have telephones and those who only have cell phones were not part of this sampling frame, so their opinions were not measured. The results of survey may not accurately reflect population.

T4.14. Many people start their day with a jolt of caffeine from coffee or a soft drink. Most experts agree that people who take in large amounts of caffeine each day may suffer from physical withdrawal symptoms if they stop ingesting their usual amounts of caffeine. Researchers recruited 11 volunteers who were caffeine dependent and who were willing to take part in a caffeine withdrawal experiment. The experiment was conducted on two 2-day periods that occurred one week apart. During one of the 2-day periods, each subject was given a capsule containing the amount of caffeine normally ingested by that subject in one day. During the other study period, the subjects were given placebos. The order in which each subject received the two types of capsules was randomized. The subjects' diets were restricted during each of the study periods. At the end of each 2-day study period, subjects were evaluated using a tapping task in which they were instructed to press a button 200 times as fast as they could.⁶⁶

- (a) How and why was blocking used in the design of this experiment? Each

This is a matched pairs study. Each of the 11 individuals will be blocks. Each participant will take the caffeine on one day and the placebo on the other. The order in which they take the placebo or caffeine is decided randomly. The tapping test is administered at the end of each 2 day trial - The results to be compared are differences between the caffeine and placebo scores on the tapping test.

- (b) Why did researchers randomize the order in which subjects received the two treatments?

The order was randomized to control for any possible influences on the order in which the treatments were administered on the subjects tapping speed.

The blocking was done to control for individual differences in dexterity.

- (c) Could this experiment have been carried out in a double-blind manner? Explain.

Yes. A double blind experiment can be done so that neither the subjects nor the people who come in contact with them have knowledge of the order in which the caffeine or placebo was administered.