

Chapter 4: Designing Studies



Key Vocabulary:

- sample
- population
- sample survey
- voluntary response sample
- confounded
- design
- convenience sampling
- biased
- simple random sample
- table of random digits
- probability sample
- stratified random sample
- cluster sampling
- inference
- margin of error
- strata
- undercoverage
- nonresponse
- response bias
- sampling frame
- systematic random sample
- observational study
- experimental
- confounding
- **lurking extraneous variable**
- experimental units
- subjects
- random assignment
- treatment
- factor
- level
- placebo effect
- single blind experiment
- control group
- completely randomized experiment
- randomized block design
- matched pair design
- statistically significant
- replication
- hidden bias
- double-blind experiment
- block design
- data ethics

4.1 Sampling and Surveys (pp.206-224)

1. Explain the difference between a *population* and a *sample*.
2. What is involved in planning a *sample survey*?
3. Why might *convenience sampling* be unreliable?
4. What is a *biased* study?
5. Why are *voluntary response samples* unreliable?
6. Define *simple random sample (SRS)*.
7. What two properties of a *table of random digits* make it a good choice for creating a simple random sample?
8. State the two steps in *choosing an SRS*:
9. What is the difference between sampling *with* replacement and sampling *without* replacement?
10. How can you account for this difference *with and without replacement* when using a table of random digits or other random number generator?
11. How do you select a *stratified random sample*?

12. What is *cluster sampling*?
13. What is *inference*?
14. What is a *margin of error*?
15. What is the benefit of a *larger* sample size?
16. A *sampling frame* is...
17. Give an example of *undercoverage* in a sample.
18. Give an example of *nonresponse bias* in a sample.
19. Give an example of *response bias* in a sample.
20. How can the wording of questions cause *bias* in a sample?
21. Answer the two questions for the *Check Your Understanding* on page 224.

4.2 Experiments (pp.231-251)

1. Explain the differences between *observational study* and *experiment*.
2. A *lurking variable* is...
3. What problems can lurking variables cause?
4. *Confounding* occurs when...
5. Answer the four questions for the *Check Your Understanding* on page 233.
6. Explain the difference between *experimental units* and *subjects*.
7. Define *treatment*.
8. By studying the TV Advertising example on page 235, identify the *factors* and *levels* in the experiment.
9. Explain why the example, *Which Works Better: Online or In-Class SAT Preparation*, is a bad experiment.
10. What is *random assignment*?
11. What is a *comparative* experimental design?
12. In a *completely randomized design*...

13. Does using chance to assign treatments in an experiment guarantee a completely randomized design? Explain.
14. What is the significance of using a *control group*?
15. The basic *principles of statistical design* experiments are:
16. Define *control*, *random assignment* and *replication* in experimental design.
17. Describe the *placebo effect*.
18. What are the differences between a *double-blind* and *single-blind* experiment?
19. Define *statistically significant*.
20. What is a *block*?
21. What is a *randomized block design*?
22. When does *randomization* take place in a block design, and how does this differ to a completely randomized design?
23. What is the goal of a *matched pairs design*?
24. When is it beneficial to use a blocked/paired design? How should we choose which variables to block for?

4.3 Using Studies Wisely (pp.261-267)

1. Name the two *types of inferences* that can be identified based on the design of a study.
2. Name the *challenges* of establishing causation.
3. What are the four criteria for *establishing causation* when we can't do an experiment?
4. Briefly describe the basics of *data ethics*.