

# Collecting Data: Sampling Plans and Experiments

Grade 12 – AP Statistics math · Worksheet · Standards: AP Statistics Unit 1 (2026-27)

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

These twenty problems cover the data-collection ideas of AP Statistics Unit 1: statistical questions, sampling methods, sources of bias, observational studies, experimental design and scope of inference. Later problems ask for complete written designs and critiques.

**Standards:** AP Statistics Unit 1 (2026-27) · **Level:** Grade 12 AP Statistics

## Problem 1 Statistical or Not (easy)

Decide whether each question is a statistical question (one that expects variability in the answers). Explain briefly.

- How many players are on the roster of the Lincoln High soccer team?
- How many text messages do Lincoln High students send on a typical day?
- What is the height of each player on the soccer team?

## Problem 2 Systematic Sampling (easy)

A principal has an alphabetical list of 800 students. She randomly picks a starting number from 1 to 20, gets 4, and surveys the 4th student, then every 20th student after that. Name the sampling method and explain why it is not an SRS.

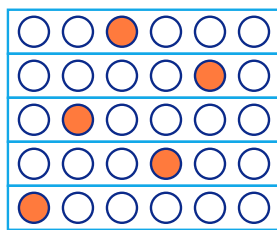
## Problem 3 Identifying Cluster Sampling (easy)

A county has 36 bus routes. The transportation office randomly selects 5 routes and surveys every rider on those 5 routes. Name the sampling method and state one advantage and one risk.

## Problem 4 Stratified Sample Design (medium)

A fitness club wants opinions on a new class schedule. The 30 members shown are grouped by membership type (each row is one type). One member is chosen from every row.

### Members by type



*Each row is a membership type.*

Name the sampling method and explain why a club would choose it instead of an SRS.

### Problem 5 Voluntary Response Bias (easy)

A radio station asks listeners to call in and vote on whether the city should build a new skate park. 412 listeners call; 361 vote yes. Explain why the 87.6% yes figure should not be generalized to all residents of the city.

### Problem 6 Undercoverage (medium)

A pollster selects a random sample of numbers from the landline phone directory to estimate the percent of adults in a town who support a school bond. Identify the type of bias and the direction in which it is likely to affect the estimate if younger adults support the bond more than older adults.

### Problem 7 Wording and Response Bias (medium)

A survey asks: "Don't you agree that the cafeteria should stop selling delicious, affordable pizza?" (a) Identify the problem. (b) Rewrite the question so that it is neutral.

### Problem 8 Observational Study or Experiment (medium)

Classify each study as an observational study or an experiment.

- Researchers examine school records and compare the grades of students who play an instrument with those who do not.
- A coach randomly assigns 30 swimmers to one of two warm-up routines and compares their 100-meter times.
- A nurse asks patients how many hours they sleep and records their blood pressure.

### Problem 9 Confounding Variables (medium)

A study finds that people who drink at least 3 cups of tea a day have a lower rate of heart

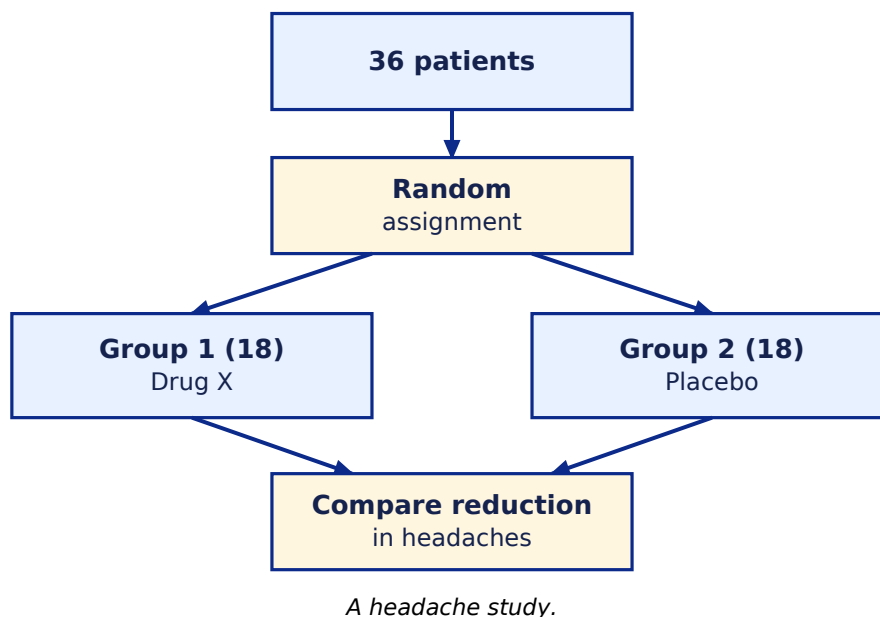
disease. The researchers did not assign how much tea anyone drank. Identify the explanatory and response variables and describe a possible confounding variable.

### Problem 10 Random Assignment with Random Numbers (medium)

Twenty hikers, labeled 1 to 20, will test two types of boots. A calculator generates these integers from 1 to 20: 3, 13, 1, 17, 3, 20, 4, 11, 5, 13, 4, 1, 16, 3, 18, 1, 6, 19, 6, 7, 5, 17, 5, 10, 14, 9, 18, 2, 9, 11. Use the list, skipping repeats, to choose 10 hikers for the new boots. Which hikers get the new boots?

### Problem 11 Parts of an Experiment (medium)

The diagram shows an experiment on a headache drug.



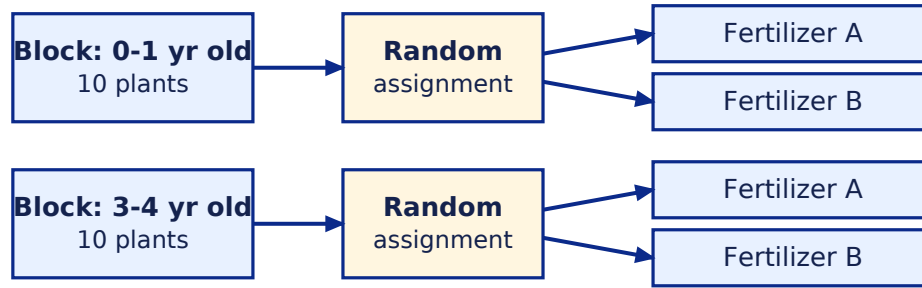
Identify the experimental units, the explanatory variable, its treatments and the response variable.

### Problem 12 Why Blinding Matters (medium)

In a study of a new back brace, the patients know whether they received the brace or a sham brace, and the doctor who rates their pain also knows. Explain how a double-blind design would remove bias, and describe who must be blinded.

### Problem 13 Randomized Block Design (hard)

A gardener tests two fertilizers on 20 rose plants. Ten are young plants and ten are mature plants, and age strongly affects growth.



*Plants blocked by age.*

Explain why blocking by age is better than a completely randomized design here and describe how to randomize.

#### **Problem 14 Matched Pairs Design** (hard)

A researcher compares two brands of running shoes using 15 runners. Describe a matched-pairs design where each runner tests both brands, including how randomization is used and what is compared.

#### **Problem 15 Scope of Inference** (hard)

For each study, state whether the results can be generalized to a larger population, whether a cause-and-effect conclusion is justified, or both.

- A school randomly samples 120 of its 1,500 students and asks about sleep. No treatment is imposed.
- Twenty-four volunteers from a gym are randomly assigned to one of two diets and weight changes are compared.
- A random sample of 200 adults in a state is chosen and each is randomly assigned to one of two reminder letters; later the response rates are compared.

#### **Problem 16 Sample Size and Variability** (medium)

A pollster takes many random samples of size 50 and many random samples of size 800 from the same large population. The sample proportions from the size-50 samples range from 0.30 to 0.70; those from the size-800 samples range from 0.45 to 0.55. What does this show about sample size? Does a larger sample remove bias from a poorly designed survey?

#### **Problem 17 Design an Experiment** (hard)

A school wants to find out whether listening to instrumental music while studying changes vocabulary quiz scores. Eighty volunteers are available. Describe a completely randomized design, including treatments, random assignment, control and the comparison.

### Problem 18 Critique a Flawed Experiment (hard)

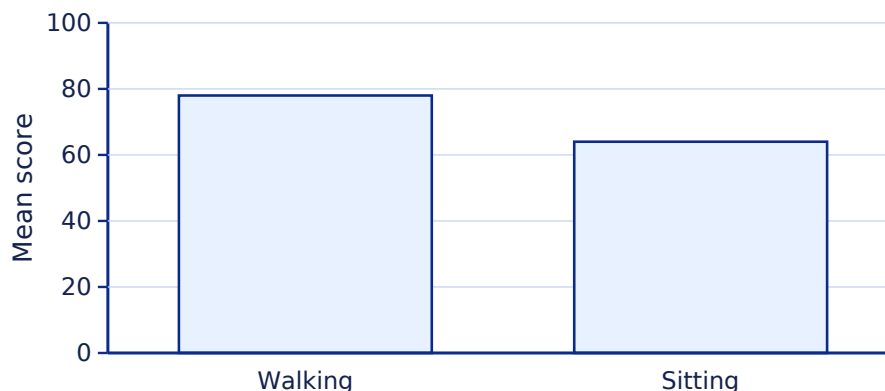
A teacher wants to know whether flashcards help students learn spelling words. She gives flashcards to her first-period class and none to her fifth-period class, then compares their test scores. First period meets at 8 a.m. and fifth period right after lunch. Explain why she cannot conclude that flashcards cause a difference and suggest an improvement.

### Problem 19 Multiple Sources of Bias (hard)

A company mails a questionnaire to 3,000 customers chosen at random and asks, "How satisfied are you with our fantastic, award-winning service?" Only 270 customers return it. Identify two sources of bias and explain how each could affect the result.

### Problem 20 Interpreting a Study Result (hard)

Sixty volunteers from a college were randomly assigned to walk 15 minutes (30 students) or sit quietly 15 minutes (30 students) before a memory test. The bar graph shows the mean scores.



*Mean memory scores in a randomized study.*

The difference ( $78 - 64 = 14$  points) is much larger than expected from random assignment alone. What conclusion about cause and effect is justified? To whom can the results be extended?