

# Population, Sample & Sampling Techniques

Statistics Worksheet · Grade 9–12

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Learning Objectives

- Distinguish between a population and a sample, and identify census vs. sampling
- Use correct statistical notation ( $\mu$ ,  $\sigma$ ,  $x$ ,  $s$ ) for population and sample measures
- Identify and apply simple random, stratified, cluster, and multistage sampling techniques

## Problems

1. A school principal wants to find the average GPA of every student enrolled at Lincoln High School. She collects GPA data from all 1,200 students. Does this situation describe a population or a sample? Explain your reasoning.

2. A researcher wants to know the average commute time of workers in a large city. She randomly selects 200 workers and records their commute times. Identify whether this represents a population or a sample, and state the correct notation for the average she calculates.

$\bar{x}$

3. Match each description to the correct term: census, sampling, population, or sample. Write the correct term next to each letter. (A) The entire group you want information about. (B) A subset chosen from the larger group. (C) Collecting data from every member of the group. (D) Collecting data from only part of the group.

4. Fill in the table below by selecting the correct statistical notation for each measure depending on whether it comes from a population or a sample.

Measure	Population Notation	Sample Notation
Mean		
Standard Deviation		

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5. A gym records the resting heart rate of every member on its roster (850 members total) and finds an average resting heart rate of 72 beats per minute. Write the correct mathematical statement using the appropriate notation for this average.

$$\mu = 72 \text{ bpm}$$

6. A teacher wants to survey students about their study habits. She puts all 30 student names in a hat and draws 8 names. Each drawn student is surveyed. What sampling technique is this, and why does it qualify as that type?

7. A principal wants to survey students about cafeteria food. The school has 400 freshmen, 380 sophomores, 360 juniors, and 360 seniors. She randomly selects 20 students from each grade level. Identify the sampling technique used and explain what makes it different from a simple random sample.

8. A city health department wants to study exercise habits across its 60 neighborhoods. Instead of sampling individuals directly, they randomly select 10 neighborhoods and then survey every resident in those chosen neighborhoods. Identify this sampling technique and explain how cluster sampling differs from stratified sampling.

9. Researchers studying reading levels across a large school district first randomly select 5 schools from 40 (cluster step), then within each selected school they randomly select 3 classrooms (stratified step), and finally randomly select 10 students from each classroom (simple random step). Identify the overall sampling technique and explain why it is used.

10. A nationwide polling company surveys 1,500 randomly selected adults and finds that 62% approve of a new education policy, with a sample standard deviation of 4.3 percentage points. The company claims this represents all adults in the country. (A) Identify the population and the sample. (B) Write the correct notation for the mean approval percentage and the standard deviation based on the data collected. (C) Explain one potential source of bias that could make this sample unrepresentative of the population, and suggest which sampling technique would best minimize it.

$$\bar{x} = 62\%, \quad s = 4.3\%$$

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# Population, Sample & Sampling Techniques — Answer Key

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## Answer Key

### 1. Answer: Population — all students were included

- A population includes every individual in the entire group of interest.
- Since the principal collected data from ALL 1,200 students — not just a subset — this is a population study.
- Answer: Population

### 2. Answer: Sample; notation is $\bar{x}$ (x-bar)

- A sample is a subset of the population — only 200 workers out of all city workers were selected.
- Because the data comes from a sample, the mean is denoted  $\bar{x}$  (x-bar), not  $\mu$ .
- Answer: Sample;  $\bar{x}$

### 3. Answer: A = Population, B = Sample, C = Census, D = Sampling

- Population = the entire group under study.
- Sample = a subset of the population.
- Census = collecting data from every member of the population.
- Sampling = collecting data from only part of the population (the sample).

### 4. Answer: See completed table

Measure	Population Notation	Sample Notation
Mean	$\mu$ (mu)	$\bar{x}$ (x-bar)
Standard Deviation	$\sigma$ (sigma)	s

- For populations, Greek letters are used: mean =  $\mu$ , standard deviation =  $\sigma$ .
- For samples, Latin letters are used: mean =  $\bar{x}$ , standard deviation = s.
- This distinction is essential for communicating statistical results correctly.

### 5. Answer: $\mu = 72$ bpm

- All 850 members were measured, so this is a population study.
- The population mean is represented by  $\mu$  (mu).
- Correct notation:  $\mu = 72$  bpm

### 6. Answer: Simple Random Sample — every student had an equal chance of being selected

- Simple random sampling gives every individual in the population an equal chance of being chosen.
- Drawing names from a hat ensures each of the 30 students has the same probability of selection.
- Answer: Simple Random Sample

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**7. Answer: Stratified Random Sample — population divided into grade-level groups (strata), then randomly sampled from each**

- Stratified random sampling divides the population into subgroups (strata) based on a shared characteristic — here, grade level.
- A random sample is then taken from each stratum.
- Unlike simple random sampling, this guarantees representation from every grade level.
- Answer: Stratified Random Sample

**8. Answer: Cluster Sampling — entire groups (clusters) are selected, not individuals from every group**

- Cluster sampling divides the population into groups (clusters) and randomly selects entire clusters to study.
- In this case, the 60 neighborhoods are the clusters; 10 are chosen and all residents in those 10 are surveyed.
- Stratified sampling takes a random sample FROM each subgroup; cluster sampling surveys ALL members of selected groups.
- Answer: Cluster Sampling

**9. Answer: Multistage Sampling — multiple different sampling techniques are combined across stages**

- Multistage sampling uses more than one sampling technique applied in successive stages.
- Stage 1: Cluster sampling — 5 schools randomly chosen from 40.
- Stage 2: Stratified/cluster — 3 classrooms randomly selected within each school.
- Stage 3: Simple random sample — 10 students randomly selected from each classroom.
- This approach is practical for large, geographically spread populations.

**10. Answer: Population = all adults in the country; Sample = 1,500 surveyed adults; Notation:  $x = 62%$ ,  $s = 4.3%$ ; Technique: Stratified random sampling by region/demographic**

- (A) Population: all adults in the country. Sample: the 1,500 randomly selected adults who were surveyed.
- (B) Because data was collected from a sample (not the entire population), use sample notation:  $x = 62%$  for the mean,  $s = 4.3%$  for the standard deviation.
- (C) Potential bias: If the sample was drawn only from certain regions or demographics (e.g., only urban adults or only phone users), it may not represent rural or non-phone-owning adults.
- Best technique to minimize this: Stratified random sampling — divide the population into strata (e.g., by region, age group, income level) and randomly sample from each stratum to ensure all subgroups are represented.

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