# Sampling, Center and Spread

Use this key to check answers and read the explanations.

1. A school district wants to learn what all its sixth graders think about lunch menus. Researchers collect answers from four sixth-grade classes. What is the population of interest?

A. All sixth graders in the district
B. Only the students in the four selected classes
C. All students in every grade in the district
D. Only sixth graders who like their lunches

Correct answer: A. All sixth graders in the district
The population is the whole group the researchers want to understand. When answers come from selected classes, those respondents form the sample.

2. A gardener randomly selects 20 trees from an orchard of 200 trees. The selected trees average 3 meters tall. What kind of number is that average?

A. A population count
B. A known population parameter
C. A sample statistic
D. A margin of error

Correct answer: C. A sample statistic
The average came from measurements of the selected trees. It is a sample statistic, which could help estimate the average for the whole orchard.

3. For a camp event, the median wait is 15 minutes. Which statement must be true of the recorded waits?

A. Exactly half are shorter than 15 minutes.
B. At least half are 15 minutes or less.
C. All the waits are exactly 15 minutes.
D. The arithmetic mean is exactly 15 minutes.

Correct answer: B. At least half are 15 minutes or less.
The median marks the middle of the ordered waits. At least half are no greater than it, and ties can put more than half at or below it.

4. A report lists the mean and standard deviation of several travel times. What does the standard deviation help describe?

A. What percentage of trips reached exactly the mean
B. How many trips were recorded
C. Which trip lasted the longest
D. How spread out the times are around the mean

Correct answer: D. How spread out the times are around the mean
Standard deviation measures spread by using the distances of observations from the mean. It does not identify individual trips or count how many occurred.

5. In a sample of 80 readers, 20 ask the library to extend its hours. What percentage of this sample asks for longer hours?

A. 20%
B. 25%
C. 40%
D. 75%

Correct answer: B. 25%
Divide the 20 favorable responses by the 80 readers. One quarter of the sample is 25%.

6. Organizers want feedback from all the ticket holders at a festival. Which method gives every equally sized sample the same chance to be selected?

A. Randomly draw ticket holders from the complete ticket list without replacement.
B. Ask every person who waits at the busiest entrance to reply.
C. Put up a sign and let interested ticket holders volunteer.
D. Ask only the ticket holders who arrived before noon.

Correct answer: A. Randomly draw ticket holders from the complete ticket list without replacement.
Start from the complete list and select randomly without replacement. The other approaches depend on when people arrived, where they went or whether they volunteered.

7. A school has 400 day students and 100 evening students. A proportional stratified sample should contain 25 students. How many should be randomly selected from each group?

A. 10 day and 15 evening
B. 25 day and 0 evening
C. 15 day and 10 evening
D. 20 day and 5 evening

Correct answer: D. 20 day and 5 evening
Day students make up 400 of 500 students, or four fifths. Four fifths of 25 is 20, leaving 5 places for evening students.

8. A transit agency randomly picks 100 riders for a survey. Only 14 reply. Why could the answers still give a biased picture of the riders?

A. A smaller reply count makes answers biased regardless of who replies.
B. Random selection guarantees the 14 replies represent everyone.
C. The people who reply may differ systematically from those who do not.
D. The low reply count makes the survey an experiment.

Correct answer: C. The people who reply may differ systematically from those who do not.
Random selection helps at the invitation stage. If willingness to reply relates to riders' experiences, the answers may overrepresent some experiences.

9. The lower quartile of a set of prices is 12 dollars and the upper quartile is 33 dollars. What is the interquartile range?

A. 21 dollars
B. 12 dollars
C. 33 dollars
D. 45 dollars

Correct answer: A. 21 dollars
Subtract the lower quartile from the upper quartile. The result is 33 minus 12, or 21 dollars.

10. Two groups report a median wait of 18 minutes. Group A has an interquartile range of 2 minutes and Group B has an interquartile range of 6 minutes. Which conclusion follows?

A. Group A must have the larger overall range.
B. Group B must have the longest single wait.
C. The middle halves of the two groups occupy equal-width intervals.
D. The middle half of Group B's waits occupies a wider interval.

Correct answer: D. The middle half of Group B's waits occupies a wider interval.
The interquartile range describes the width between the lower and upper quartiles. The middle interval is wider in Group B. The endpoints of either whole set are unknown.

11. Twelve morning visitors wait an average of 18 minutes. Eight evening visitors wait an average of 23 minutes. What is the mean wait for all 20 visitors?

A. 21 minutes
B. 20.5 minutes
C. 20 minutes
D. 22 minutes

Correct answer: C. 20 minutes
The two groups contribute 216 and 184 total minutes. Together that is 400 minutes for 20 people, giving 20 minutes per person.

12. An app added 3 minutes to every recorded delivery duration by mistake. Each recorded time is corrected by subtracting 3 minutes. What happens to the mean and interquartile range?

A. Both fall by 3 minutes.
B. The mean falls by 3 minutes and the interquartile range stays the same.
C. The mean stays the same and the interquartile range falls by 3 minutes.
D. The mean rises by 3 minutes and the interquartile range stays the same.

Correct answer: B. The mean falls by 3 minutes and the interquartile range stays the same.
Subtracting 3 from every value shifts the mean down by 3. Both quartiles shift down by 3, so the gap between them remains unchanged.

13. A set of values has lower quartile 14 and upper quartile 22. A value is flagged as a potential high outlier only if it is greater than the upper quartile plus 1.5 times the interquartile range. Which value is flagged?

A. 22
B. 34
C. 33
D. 37

Correct answer: D. 37
The interquartile range is 8, so the cutoff is 22 plus 1.5 times 8, or 34. Only 37 is strictly above it.

14. Of 120 invited survey participants, 80 reply, and 48 of the replies support a proposal. Among all 120 invited people, what are the fewest and most who could support it?

A. 48 and 88
B. 48 and 80
C. 40 and 88
D. 80 and 120

Correct answer: A. 48 and 88
There are 40 people whose views are unknown. Support can be as low as the 48 counted replies or as high as 48 plus all 40 people without replies.

15. In a morning shift, Team A meets its target on 12 of 15 tasks and Team B on 8 of 10. In the evening, Team A meets it on 2 of 10 and Team B on 3 of 15. Which interpretation fits the counts?

A. The teams match within each shift and in their combined rates.
B. Team A has a higher rate within both shifts and overall.
C. The teams match within each shift, but Team A has the higher combined rate.
D. Team B has the higher combined rate because it succeeds on more evening tasks.

Correct answer: C. The teams match within each shift, but Team A has the higher combined rate. Both teams succeed on 80% of morning tasks and 20% of evening tasks. The combined rates are 14/25 for A and 11/25 for B because the teams have different mixes of tasks across shifts.