End-of-Unit Assessment (A)

Teacher Instructions

Use of a four-function or scientific calculator is acceptable, but should not provide a significant advantage. Do not allow use of more advanced calculators that may include functions to draw data displays, or to calculate the mean, median, MAD, or IQR directly.

1

Standards

Addressing **6.RP.A.3.c, 6.SP.B.4**

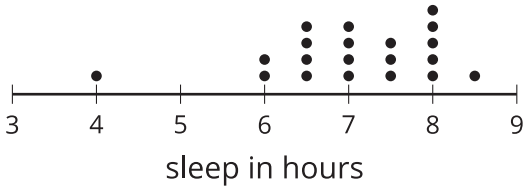
Narrative

Students analyze a dot plot, including simple questions about spread and distribution. Students are asked to calculate percentages: There are 20 data points to make calculations simpler.

Students who don't select Choice A may have mistaken the group of 5 as one, may have miscounted, or may misunderstand the difference between "at least" and "more than." Students who select Choice B have confused "mean" with "midrange" (the average of the largest and smallest values). Students who don't select Choice C may not be accounting for the frequencies when determining information in a dot plot. Students who select Choice D misunderstand the difference in meaning between "1% of students" and the data point indicating one student. Students who select Choice E likely excluded 4 hours as an outlier.

Student Task Statement

This dot plot shows the number of hours 20 sixth grade students slept on a Saturday night.



Select **all** the true statements about the data used to build the dot plot.

A. Six students slept for at least 8 hours.

B. The mean amount of sleep was 6.25 hours.

C. More than half of the students slept 7 hours or less.

D. Only 1% of the students slept more than 8 hours.

E. The difference between the most hours of sleep and the least for these students was 2.5 hours.

Solution

A, C

2

Standards

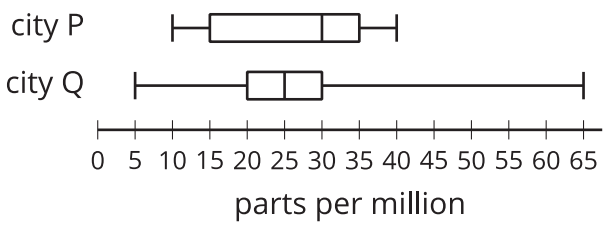
Addressing **6.SP.B.4, 6.SP.B.5.c**

Narrative

Students who don't select Choice A are looking at the box instead of the whiskers. Students who don't select Choice B may have misinterpreted "50 parts per million" as a division, ignoring the label of the box plot. Students who select Choice C may be attempting to judge the mean by the overall location of the box plots, but no such judgment can be made. Students who don't select Choice D are looking at the IQR instead of the range. Students who select Choice C instead of Choice E may think box plots indicate means instead of medians.

Student Task Statement

The air quality was tested in many office buildings in two cities. The results of the testing are shown in these box plots.



A level of less than 50 parts per million is considered healthy. A level of 50 or more parts per million is considered unhealthy.

Select **all** the statements that must be true.

A. The lowest recorded measurement was in city Q.

B. All buildings tested in city P are in the healthy range.

C. The mean for city P is greater than the mean for city Q.

D. The range for city Q is greater than the range for city P.

E. The median for city P is greater than the median for city Q.

Solution

A, B, D, E

3

Standards

Addressing **7.SP.A.1**

Narrative

Students who select choice A noticed the overall shape of the distribution but did not take into account the large peak of data at 5 minutes. Students who select choice B noticed the overall shape of the distribution but did not notice a shift in the data. Students who select choice C may believe that samples must have a symmetric distribution, which is not true.

Student Task Statement

Here is a dot plot showing how much time customers spent in a store, rounded to the nearest five minutes.

Which of the following is a representative sample of this population?

A

B

C

D

A. A

B. B

C. C

D. D

Solution

D

4 Standards

Addressing **6.SP.A.3, 6.SP.B.5.c**

Narrative

Watch for students attempting to answer the question without first sorting the data (those students will give a median of 6.5). Also watch for students excluding the center 6 values from the quartile calculation, which leads to an incorrect (larger) IQR.

Student Task Statement

Ten students each attempted 10 free throws. This list shows how many free throws each student made.

8 5 6 6 4 9 7 6 5 9

a. What is the median number of free throws made?

b. What is the IQR (interquartile range)?

Solution

a. 6 free throws. (The ordered list is $4, 5, 5, 6, 6, 6, 7, 8, 9, 9$. The two middle terms in the ordered list are both 6.)

b. 3 free throws. (The first half of the data is $4, 5, 5, 6, 6$; its median is 5. The second half of the data is $6, 7, 8, 9, 9$; its median is 8. The IQR is 3, since $8 - 5 = 3$.)

5 Standards

Addressing **6.SP.A.3, 6.SP.B.4**

Narrative

For the second question, accept any answer from 20 to 40 centimeters. The mean of the data is 39.25 centimeters, but students should not need this calculation to answer the question. Watch for students making minor errors in building the histogram. The problem does not specify the intervals that students must use, so accept alternate correct histograms. Nearly all students will use the intervals provided.

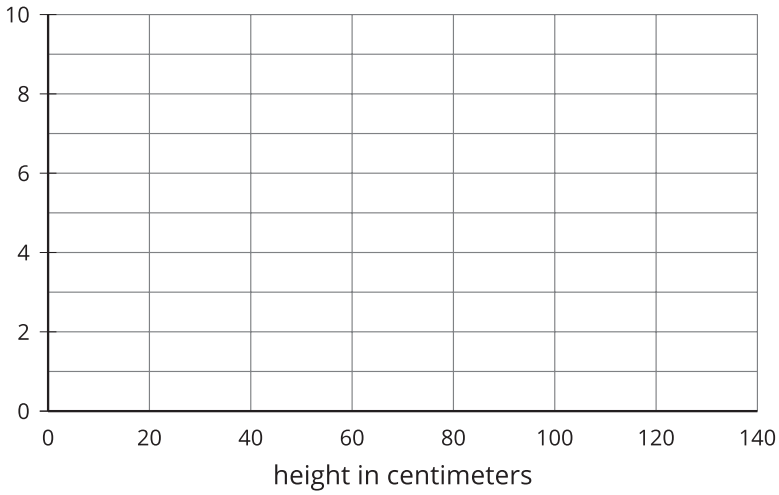
Student Task Statement

Here is the height of 20 flowers in the school garden, in centimeters.

5 5 10 10 15 25 25 25 25 30 30 35 45 45 50 55 65 70 105 110

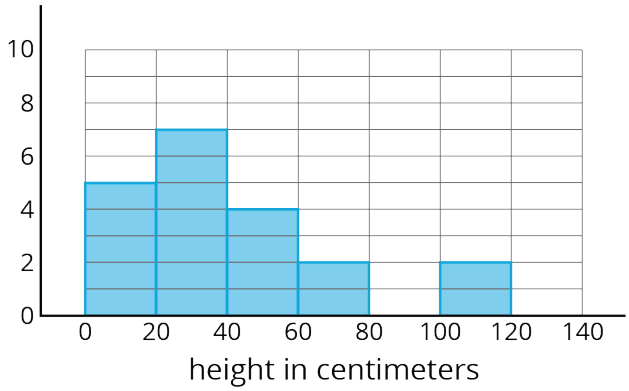
a. Draw a histogram to display the data.

b. Based on the histogram, what is a typical length for these 20 flowers?



Solution

a.



b. Sample response: About 20–40 centimeters. Most of the flowers are in the 20–40 centimeter interval with a few more flowers greater than 40 than less than 20, so maybe closer to 40.

Tier 1 response:

- Accurate, correct work.
- All histogram bar heights are correct, and the typical length given is in the 20–40 cm range.

Tier 2 response:

- Work shows general conceptual understanding and mastery, with some errors.
- Sample errors: One or two mistakes in histogram bar heights; correct histogram but a typical length above 40 cm given.

Tier 3 response:

- Significant errors in work demonstrate lack of conceptual understanding or mastery.
- Sample errors: Major mistakes in histogram bar heights; attempt to draw a different type of plot; mistakes in histogram and an incorrect typical length; empty or nonsensical answer to typical length question.

6

Standards

Addressing **7.SP.A.1**

Narrative

This item checks whether students understand the meanings of the terms “population” and “sample” as well as their uses in context. For the first question, the answer must acknowledge all the people that regularly spend time in the school, not just students. There is lots of flexibility in acceptable responses to the second question since the item doesn't say how large the school is, but it should mention using a random process.

Student Task Statement

An administrator of a large middle school is installing some vending machines in the cafeteria and teacher’s lounge. She wants to know what type of machine would be most popular.

a. What is the population for the administrator’s question?

b. Give an example of a sample the administrator could use to help answer her question that is likely to be representative.

Solution

Sample response:

a. The population is current students, teachers, and staff of the school.

b. Use a list of students, teachers, and staff, and select 30 of them at random.

7

Standards

Addressing **6.SP.B.4, 6.SP.B.5.a, 6.SP.B.5.c, 6.SP.B.5.d**

Narrative

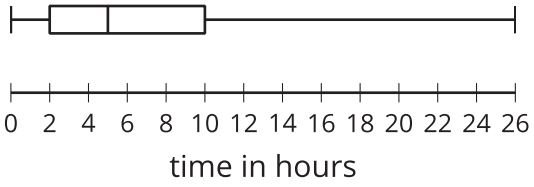
This question is about the limitations of the histogram and box plot, which provide only partial information about a distribution. Notably, one display may be more useful than another depending on the question asked about the data.

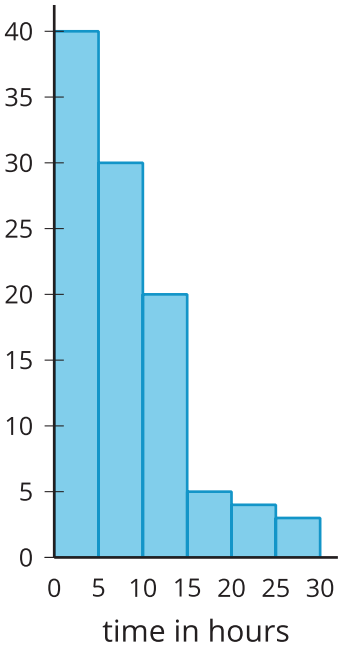
Student Task Statement

Jada asked some students at her school how many hours they spent watching television last week, to the nearest hour. Here are a box plot and a histogram for the data she collected.

Box plot:

Histogram:





a. About how many students did Jada ask?

b. Is the mean or the median a more appropriate measure of center for this data set? Explain your reasoning.

c. Can Jada use these data displays to find the exact median? Explain how you know.

d. Can Jada use these data displays to find the exact mean?

e. What would be an appropriate measure of variability for this data set? Find or estimate its value.

Solution

a. Jada asked about 100 students.

b. The median is more appropriate because the data is not symmetric.

c. Yes, the box plot gives the exact median, 5 hours.

d. No

e. Sample response: The IQR (interquartile range) is appropriate because the median is being used as a measure of center. The box plot gives the IQR of 8 hours because $10 - 2 = 8$.

Tier 1 response:

- Accurate, correct work.
- Correct answer to each question, description of why IQR is an appropriate measure of spread, correct IQR.
- Acceptable errors: Mistake in determining median or IQR caused by a misreading of the box plot.

Tier 2 response:

- Work shows good conceptual understanding and mastery, with minor errors.
- Sample errors: Incorrect response for histogram total, larger than 6; stating that the data is symmetric; attempt to calculate precise mean; incorrect or missing IQR calculation.
- Acceptable errors: Incorrect MAD estimation, given (incorrect) statement that data is symmetric.

Tier 3 response:

- Work shows a developing but incomplete conceptual understanding, with significant errors.
- Sample errors: Two or more error types from Tier 2 response; incorrect response for histogram total, 6 or fewer; incorrect median; invalid use of box plot to determine mean.

Tier 4 response:

- Work includes major errors or omissions that demonstrate a lack of conceptual understanding and mastery.
- Sample errors: Three or more error types from Tier 2 response; two or more error types from Tier 3 response; multiple omitted parts.