Investigation 1

ACE Assignment Choices

Differentiated Instruction

Problem 1.1

Core 1, 22–25

Problem 1.2

Core 2, 5–12
Other *Applications* 3, 4; *Connections* 26–28; unassigned choices from previous problems

Problem 1.3

Core 13
Other *Connections* 29, 30; unassigned choices from previous problems

Problem 1.4

Core 14–20, 31
Other *Connections* 32, *Extensions* 40–43; unassigned choices from previous problems

Problem 1.5

Core 21
Other *Extensions* 33–39; unassigned choices from previous problems

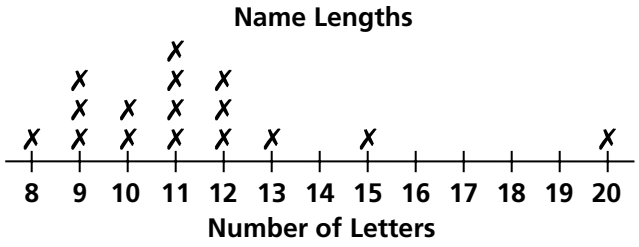
Adapted For suggestions about adapting Exercises 3–6 and other ACE exercises, see the CMP *Special Needs Handbook*.

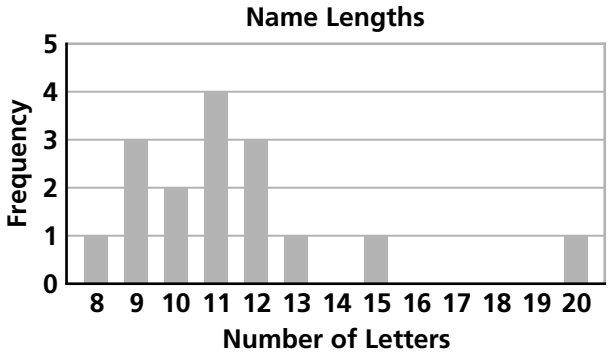
Applications

1.

Name Lengths

Name	Number of Letters
Ben Foster	9
Ava Baker	8
Lucas Fuentes	12
Juan Norinda	11
Ron Weaver	9
Bryan Wong	9
Toby Vanhook	11
Katrina Roberson	15
Rosita Ramirez	13
Kimberly Pace	12
Paula Wheeler	12
Darnell Fay	10
Jeremy Yosho	11
Cora Harris	10
Corey Brooks	11
Tijuana Degraffenreid	20

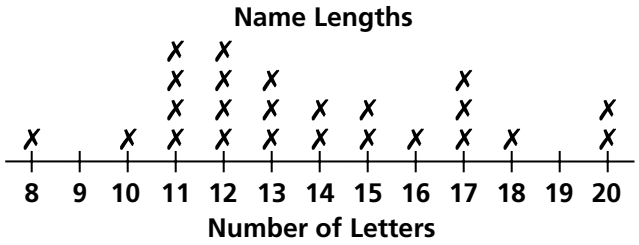




ACE ANSWERS 1

2. The median name length is 11 letters, and the range of the data is 12 letters. A name length of 20 letters is somewhat unusual. The typical number of letters is clustered around the median in an interval of 8–13 letters or 9–12 letters. The mode is the same as the median in this example, although 9 letters and 12 letters occur almost as frequently as the mode.

3. Possible answer:



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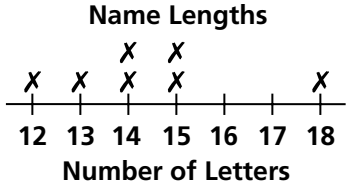

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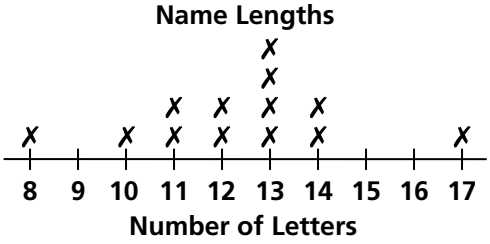
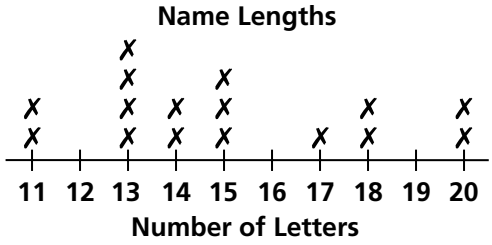


6. Possible answer:



7. Possible answer: The data distribution from Ms. Campo's class shows that the typical number of letters is clustered around the median in an interval of 10–17 or 12–16 letters. This is slightly higher than the data distribution from Mr. Young's class. The data for Ms. Campo's class vary from 10 to 19 letters; the data for Mr. Young's class vary from 8 to 20 letters.

8. C **9.** H

10. 27 students; the bar for each number represents the number of students with that name length, so adding the bar heights (1 + 2 + 4 + 3 + 4 + 7 + 3 + 2 + 1) gives the total number of students.

11. 9 letters

12. 14 letters; there are 27 name lengths, so the median occurs at the fourteenth name length, which is 14 letters.

13. a. (Figure 2)

b. The median will change because three pieces of the new data are above the original median and only one is below.

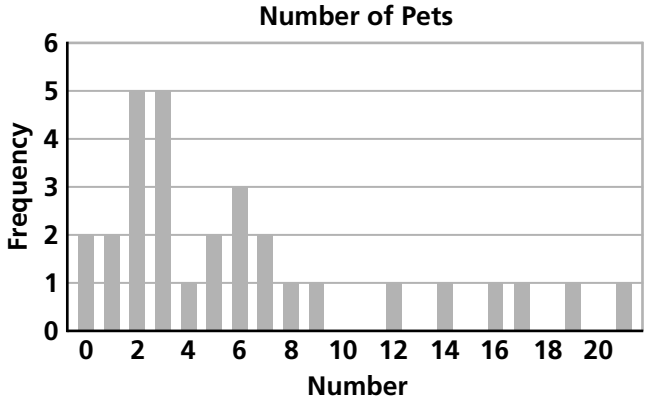
14. numerical **15.** categorical

16. categorical

17. categorical (NOTE: The question asks for "yes" or "no," not for a number.)

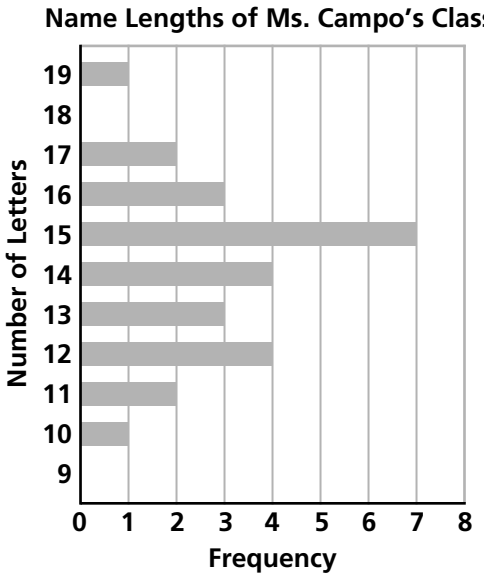
18. categorical

Figure 2



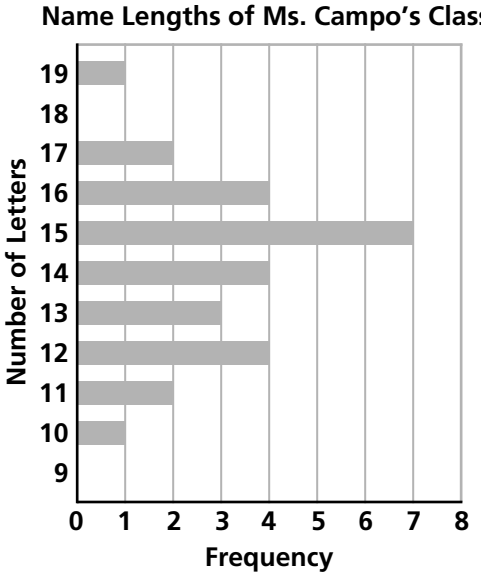
19. numerical **20.** numerical

21.



a. The median name length is 14 letters. It is the same data, just represented horizontally, so the median remains the same. (There are 27 data values; the median is the fourteenth data value, which happens to be 14 letters, in an ordered list of the data.)

b.



The median name length is $14\frac{1}{2}$ letters (There are now 28 data values; the median is the average of the fourteenth and fifteenth data values, which are 14 and 15 letters, in an ordered list of the data values.)

Connections

22. Possible answer: Graphs A and B; Graph C has values that are 0; since the students are children, their families could not have 0 children. Some students might argue that Graph A is not correct because it is unlikely that there will be a lot of families with 5, 7, and 8 children.

23. Possible answer: Graphs A and B; Graph A and Graph B are labeled 1 through 12 on the horizontal axis. However, some students might argue that in Graph B, it is unlikely that 10 students were born in February. Graph C only has labels from 0 to 9 on the horizontal axis.

24. Any of the graphs could show numbers of pizza toppings. Some students might argue that Graph C is correct because most of their friends like two or three toppings.

25. Possible answers:

Graph A: Birth Months of Students, Birth Month, Frequency

Graph B: Number of Children in Students' Families, Number of Children, Frequency

Graph C: Number of Pizza Toppings, Number of Toppings, Frequency

26. The median is the number that separates the ordered data in half. The number of people that consume 5 juice drinks in one day is near the upper end of the data, so 5 cannot be the median.

27. There are 100 students, so the median is between the fiftieth and fifty-first ordered data values. A total of 39 students consumed 0 or 1 juice drink in one day. This means the median is greater than 1 juice drink, because the fiftieth value will be in the bar that represents 2 juice drinks in one day.

28. B

29. a. $\frac{29}{100}$ **b.** $\frac{16}{100} = 16\%$

30. The total number of juice drinks students consumed is determined by evaluating each bar of the graph:

7 people $\times$ 0 juice drinks $=$ 0 juice drinks

32 people $\times$ 1 juice drink $=$ 32 juice drinks

29 people $\times$ 2 juice drinks $=$ 58 juice drinks

16 people $\times$ 3 juice drinks $=$ 48 juice drinks

6 people × 4 juice drinks = 24 juice drinks

5 people × 5 juice drinks = 25 juice drinks

3 people × 6 juice drinks = 18 juice drinks

1 person × 7 juice drinks = 7 juice drinks

1 person × 10 juice drinks = 10 juice drinks

So, 100 students consumed a total of 222 juice drinks in one day.

31. Numerical; the answer to the question, "How many juice drinks do you consume in one day?", is a number.

32. a. Half of all rats live less than $2\frac{1}{2}$ years, and half live longer than $2\frac{1}{2}$ years.

b. If Alex knew the greatest age of a rat, he would know how much longer his rat could possibly live.

Extensions

33. The bar height, 7, represents the number of stickers left. Because there were 12 to begin with, 5 have been sold.

34. The bar height, 4, represents the number of street signs left. Because there were 12 signs to begin with, 8 have been sold.

35. The bar graphs show that the number of stickers remaining is less than the number of street signs remaining. Students may want to debate this because of the "peaks" in the data. You will want to remind them that the bar graphs show the number remaining, not the number sold.

36. The store has collected \$144 from the sale of 96 name stickers.

37. The most stickers, 12, have been sold for Amanda. The fewest stickers, 2, have been sold for Ana.

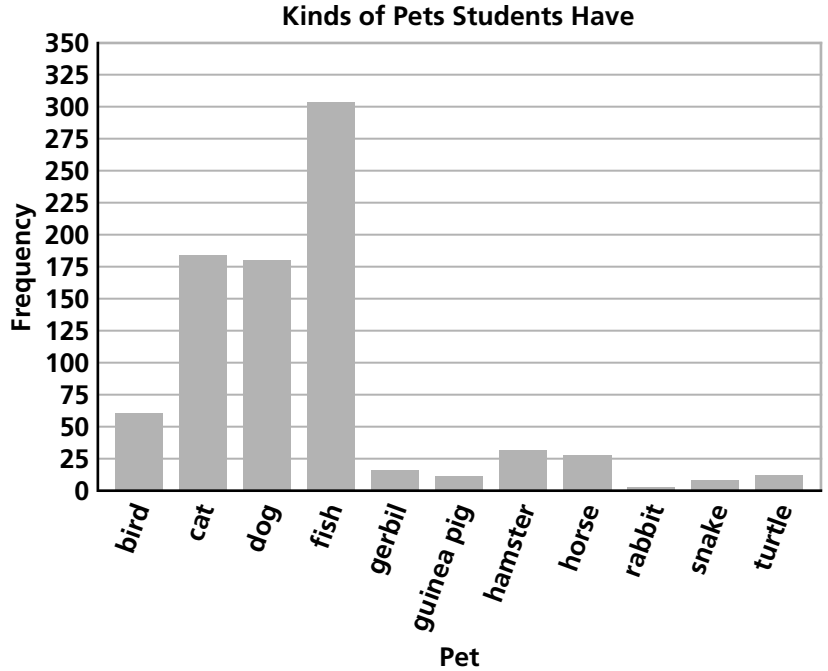
38. For Amy, the bars for stickers and signs are the same height. This shows that the numbers of stickers and signs sold are the same.

39. The stacked bars allow us to look at the data for stickers and street signs together. For example, Amanda has 0 stickers and 11 street signs left, while Alicia has 7 stickers and 4 street signs remaining. These names have the same total number of items remaining because the stacked bars are the same height. Allison and Amber are the most popular names because their stacked bars are the shortest. Ana is the least popular name because it has the highest stacked bar.

40. Possible answer: (Figure 3)

The challenge for students will be developing the scale for the vertical axis. Because of the range of the data (2 to 303 pets), the scale probably needs to be numbered by at least tens or twenties.

Figure 3



41. Possible answer: Fish occur the most frequently, followed by cats and dogs. In Problem 1.4, dogs occur most frequently, followed by cats, but the numbers are much smaller. The remaining pets are not like those of the students in Problem 1.4. Many of these pets are "indoor" pets. In Problem 1.4, many of the pets were "outdoor" pets that would live on a farm or in more rural areas.

42. Agree, because $\frac{61 + 184 + 180}{841} = \frac{425}{841} \approx 50\%$.

43. Answers will vary. Some students may immediately respond that 841 people were surveyed, indicating that each person surveyed had one pet. Other students may note that this response does not take into account that it is likely that some people surveyed had no pets or had more than one pet. This may lead students to look back at the data from Problem 1.4, where they know both the total numbers of pets and the number of people surveyed. From these data, students might find the median number of pets per person to be $3\frac{1}{2}$. Then they might divide 841 pets by 3.5 per student to get the possible number surveyed (about 240 students). Some students may raise a concern that the data from Problem 1.4 may reflect a special group of students who live in the country, and therefore, often have more pets; perhaps these particular data do not reflect the kinds of people surveyed for Problem 1.4. Students may have other strategies as well.

Possible Answers to Mathematical Reflections

1. A table of data, a line plot, and a bar graph are all tools for organizing and visualizing data. All three indicate the possible values of the item being measured (for example, 10 letters, 11 letters). A line plot and a bar graph indicate the number of times each value occurs.

A line plot has a horizontal axis that shows the possible values with marks above the numbers indicating the number of times each value occurs.

Like the line plot, a bar graph has a horizontal axis showing the possible values. Instead of using marks, the number of times a value occurs is indicated by the height of a bar over the value. A vertical axis indicates the frequency, corresponding to the height of each bar.

A line plot is usually vertical, but a bar graph can be vertical or horizontal.

2. The mode is the value in a data set that occurs most frequently. There may be more than one mode, and a mode may occur at any location in the data. The mode can describe both categorical and numerical data. In categorical data, the mode would tell you which category occurs most frequently, and in numerical data the mode tells you which numerical value occurs most frequently.

3. The median is the value that divides an ordered set of data in half; half the data are below the median, and half the data are above the median. The median is not easily affected by the addition of very high or very low values. A median can only be used with numerical data because categorical data cannot be ordered.

4. The mode and the median for a set of data may or may not be the same. For the data set 1, 2, 3, 3, 4, 5, 6, both the median and the mode are 3. For the data set 1, 1, 1, 3, 5, 6, 6, the mode is 1 and the median is 3.

5. The range indicates how spread out the data are. Combined with a measure of center such as the median or the mode, the range helps to give a picture of the data. For example, if you know a data set has a median of 20, you know where the middle of the data set is. If, in addition, you know the range is 4 (or 60), you have a much better idea of what the data may look like. Range can only be used to describe numerical data.

6. The range is the difference between the least and greatest data values.

7. The mode, median, and range can be used to describe what is typical about a data set. You can also give an interval in which most of the data values fall. Giving information about the shape of the data (peaks, gaps, clusters) also helps describe what is typical.