## Investigation

## ACE Assignment Choices

## Problem 3.1

Core 1-4
Other Connections 7, 8, 19

## Problem 3.2

Core 5, 10
Other Applications 6; Extensions 20, 21; unassigned choices from previous problems

## Problem $\mathbf{3 . 3}$

Core 11, 17, 23
Other Connections 9, 12-16, 18; Extensions 22; unassigned choices from previous problems

Adapted For suggestions about adapting Exercise 6 and other ACE exercises, see the CMP Special Needs Handbook.
Connecting to Prior Units 7, 8, 10, 12-16: Bits and Pieces I

## Applications

1. a. 3; order the data from least to greatest. The median is the value that separates the data in half.
b. Yes, six households have 3 children. The median is located using the data values. The only time the median will not be one of the data values is when it is determined by finding the mean of two middle values that are not the same.
2. a. 4; you can add the data values together and divide by the number of data values to get the mean. Or, you can find the mean by making stacks of cubes for each of the households and then evening out the stacks so there are 16 households, each with 4 members. The mean tells you the value that each data item would have if all the data had the same value.
b. There are no squares over the number 4 on the line plot, which means there are no households in the data set with four children. This is possible because there are households with more than four children and households with less than four children to balance each other.
3. C
4. a. Possible line plot:

b. Possible line plot:

c. Answers will vary.
5. Possible line plot:


For nine households to have a mean of $3 \frac{1}{3}$ people, there would have to be a total of $9 \times 3 \frac{1}{3}$, or 30 people.
6. Possible answer:


## Connections

7. $\frac{3}{4}$ hour. One way students can think of this problem is by using blocks that each represent one fourth, then making towers that correspond to the data values. For example, $\frac{3}{4}$ would be represented by a tower of three blocks, $\frac{1}{2}$ by a tower of two blocks, and so on. By distributing the blocks evenly, students can see that all the towers will have three blocks, which represents a mean of $\frac{3}{4}$.
8. G
9. a. 32 oz per player;

$$
5,760 \mathrm{oz} \div(18 \times 10) \text { players }=32 \mathrm{oz}
$$

b. The mean, because it represents the total amount of water evenly shared among the 180 players.
10. The typical price of a box of granola bars is $\$ 2.66$, and there are nine different brands of granola. So the total cost of nine boxes (one of each brand) is $\$ 23.94$. You have to price the boxes so the total cost is $\$ 23.94$. You could have the nine brands all priced at $\$ 2.66$, or have just a few priced at $\$ 2.66$, or have no brands priced at $\$ 2.66$. Here is one possibility: $\$ 2.70, \$ 2.78, \$ 2.98, \$ 2.34, \$ 2.58, \$ 2.70, \$ 2.50$, \$2.58, \$2.78
11. a. The mean tells Ralph that if all the rabbits in the data lived to be the same age, that age would be 7 years. What actually happens is that some of the rabbits don't live to 7 years and some of the rabbits live beyond 7 years.
b. Knowing the spread would give Ralph more information about the possible life span of his rabbit.
12. a. Sabrina and Diego danced $3 \frac{3}{4}$ hours and Marcus danced $2 \frac{1}{4}$ hours.
b. The mean is less than the median. The median is $3 \frac{3}{4}$ hours, and mean is less than $3 \frac{3}{4}$ hours because $2 \frac{1}{4}$ hours decreases the amount of hours each person danced.
13. No, some children may have watched videos for 39 minutes, but most children spent less or more time watching videos.
14. About $67 \%$
15. About $\frac{3}{4}$ or 0.75 of an hour
16. $2 \frac{1}{3}$ hours or about 2.3 hours
17. a. Mayor Phillips determined the mean income. The total income is $\$ 32,000$; dividing by the number of incomes, 16 , gives $\$ 2,000$ per week. Lily Jackson found the median income. There are a total of 16 values, so the median is between the eight and ninth values. The eighth value is $\$ 0$ and the ninth value is $\$ 200$, so the median is $\$ 100$. Ronnie Ruis looked at the mode, which is $\$ 0$. Each of their computations is correct.
b. No; no one earns $\$ 2,000$ per week.
c. No; no one earns $\$ 100$ per week.
d. Yes; eight people earn $\$ 0$ per week.
e. $\$ 200$ is a good answer. Possible explanation: The people who have $\$ 0$ incomes are probably children, so the people who earn $\$ 200$ and the person who earns $\$ 30,600$ are the residents who are employed. The "typical" income is either the median or the mode since the mean is greatly affected by the one large income.
f. The mode is $\$ 200$. The median is $\$ 200$. The mean is $\$ 1,640$.
18. a. Possible answer: The data are skewed to the lower values.

## Movies Watched



Key: $1 \mid 5$ means 15 movies
b. 9 movies; add to find the total number of the movies watched (225). Then divide the total by the number of students (25).
c. The mean is 9 movies, and the data vary from 1 to 30 movies. Since the mean is closer to the low end of the data values, more students fall in the low end of the data values.
d. The median number of movies watched is 8. The mean is greater than the median because the large values pull the mean up, but have less influence on the median.
19. a. $\mathrm{A}, \mathrm{B}$, and D because they are divisible by 6 .
b. 2 pens $(12 \div 6=2), 3$ pens $(18 \div 6=3)$, or 8 pens $(48 \div 6=8)$
c. I agree because an average can be found by sharing the total amount of pens evenly among all students.

## Fxtensions

20. Answers will vary. Pay attention to the students' reasoning. Generally, data reported in newspapers use the mean.
21. There are 365 days in a year. This means the average third grader watches $1,170 \div 365$, or about $3 \frac{1}{5}$ hours of television per day.
22. a. Mrs. Reid's class:
mean: $\approx 38 \frac{1}{2}(1,157 \div 30)$; median: 28
Mr. Costo's class:
mean: $54 \frac{2}{5}(1,632 \div 30)$; median: 34
The mean is greater than the median for each class, because there are some greater values in each set of data.
b. They should use the median, because it is greater than the mode.
c. The median decreases by 1 to 33 jumps. The median is the middle data value, so it is not changed much by removing the greatest data value.
d. The mean is now $(1,332 \div 29)$ or $45 \frac{27}{29}$ or 45.931. The mean decreases by a little more than 8 jumps. It decreases because the greatest value was removed, which had a big influence on the mean.
e. Mrs. Reid's class's mean and median are still less than each of the same statistics for Mr. Costo's class, so Mrs. Reid's class cannot make a valid claim that they did better.
23. a. 14
b. i. Yes, 1 is an outlier.
ii. 12.375
iii. The new mean is lower. Possible explanation: By adding the 1 to the data, the mean decreases because, like with the cube stacks in Problem 4.1, cubes need to be added to the stack of one, and this would decrease the heights of the other stacks.

## Possible Answers to Mathematical Reflections

1. Possible method: Add together all the values. Divide the sum by the number of values. This method works because the sum of the values tells us how much is to be shared or "evened out." The number of values is the number of parts into which the total must be divided. Division gives the number in each part.
2. a. They are measures of center because they are good indicators of a typical value.
b. The mode is the data value that occurs most frequently. The median is the middle value that separates an ordered set of data in half. The mean is the "balance point," or the value that each item would have if all the data had the same value.
c. The median is not greatly affected by outliers in the data.
3. The least and greatest values give the upper and lower boundaries of the data set, while the range gives the distance between these two values. A measure of center gives a typical value in the data.
4. a. The student is correct. Finding the mode just involves counting the most frequently occurring data value within a data set, so it can be used with both numerical and categorical data. Finding the mean requires dividing a sum by the number of values, and finding the median requires ordering data values from least to greatest. Both cannot be done with categorical data.
b. No; finding range depends on being able to identify the least and greatest values. You cannot order categorical data in a logical way.
