

Activity 5: What's the Average?

- PURPOSE** Investigate mean, median, and mode and examine how each average is affected by extremes in the data.
- MATERIALS** 20 strips of one-centimeter graph paper (page A-49) and a pair of scissors for each group
- GROUPING** Work individually or in groups of 3 or 4.
- GETTING STARTED** When we describe a set of data, it is often convenient to use a single number, often called the *average*, to indicate where the data are centered or concentrated. The mean, the median, and the mode are three commonly used *averages*.

Write the name of each of the following states on a strip of graph paper. Use one strip of paper for each state and one square for each letter in the name. Cut off the unused squares on the end of each strip.

Arizona, Hawaii, Ohio, Maine, Oregon, Idaho,
Texas, Louisiana, Kentucky

Arrange the names from shortest to longest, as shown in the example.

Count the number of letters in the name of each state. On a separate strip of graph paper, **write the numbers in order from least to greatest**. Write one number in each square and do not leave any blank squares between numbers. Cut off the unused squares on the end of the strip.

Example:

N	E	V	A	D	A			
M	O	N	T	A	N	A		
V	I	R	G	I	N	I	A	
W	I	S	C	O	N	S	I	N
M	I	N	N	E	S	O	T	A

6	7	8	9	9
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THE MODE

Look at the numbers on the strip. What number of letters occurs most often in the names of the states?

This is the **mode** of the numbers of letters in the names of the states.

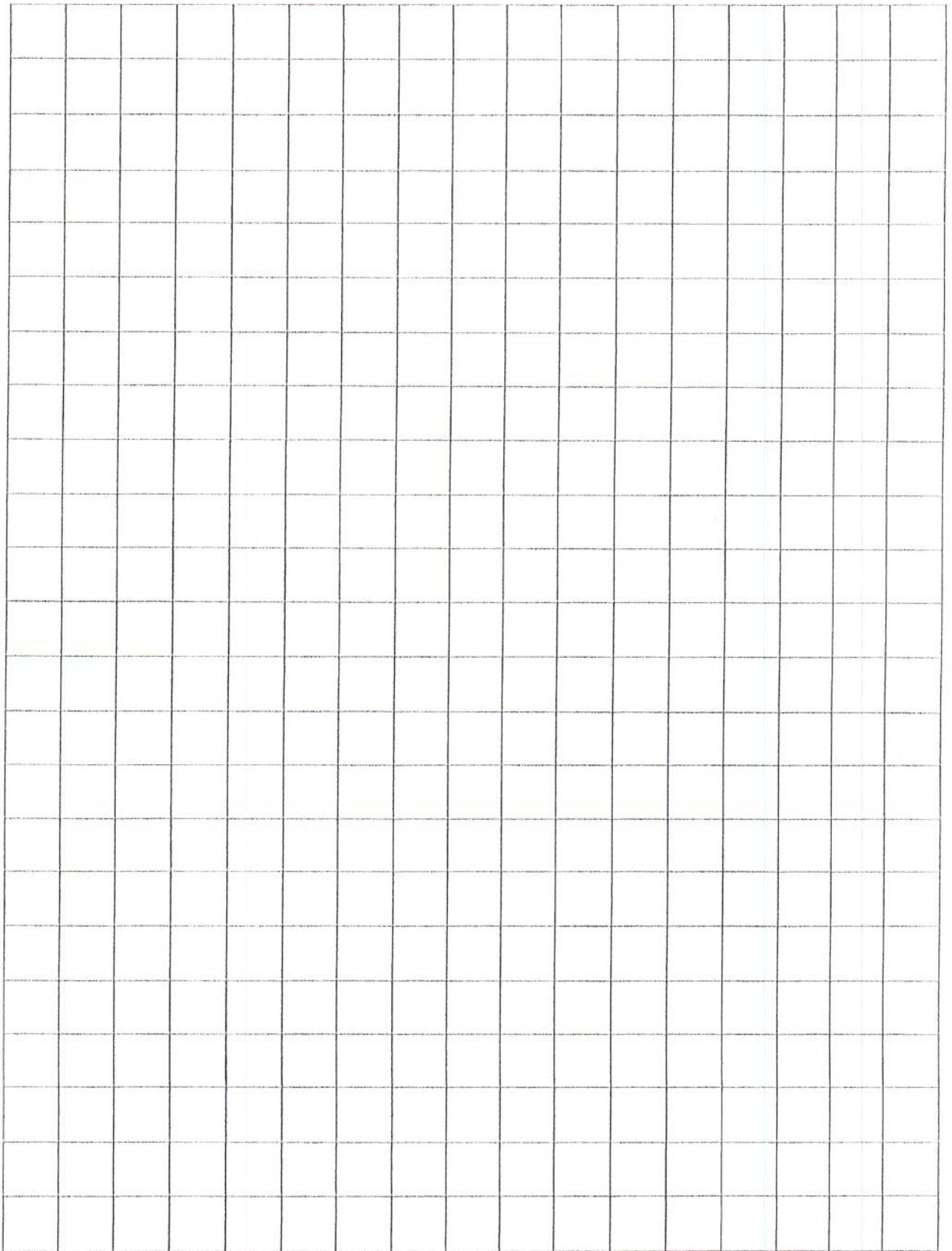
In the example, the mode is 9.

Mode
(9 letters)

N	E	V	A	D	A			
M	O	N	T	A	N	A		
V	I	R	G	I	N	I	A	
W	I	S	C	O	N	S	I	N
M	I	N	N	E	S	O	T	A

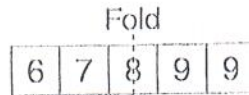
CENTIMETER GRAPH PAPER

A-49



THE MEDIAN

1. Fold the strip containing the numbers of letters in the names of the states in half by folding the ends together.
2. Unfold the strip. Through which number does the fold pass?



N	E	V	A	D	A
---	---	---	---	---	---

M	O	N	T	A	N	A
---	---	---	---	---	---	---

Median →
(8 letters)

V	I	R	G	I	N	I	A
---	---	---	---	---	---	---	---

W	I	S	C	O	N	S	S	I	N
---	---	---	---	---	---	---	---	---	---

M	I	N	N	E	S	O	T	A
---	---	---	---	---	---	---	---	---

This is the **median** number of letters in the names of the states. In the example, the median is 8.

3. If the fold is on the line between two numbers, what number would you use for the median? Why?
4. How many states have names that contain fewer letters than the median? more letters than the median?

THE MEAN

To find the **mean** of the numbers of letters in the names, cut off letters from the longer names and move them to fill in the shorter ones. Continue cutting off and moving letters until all the rows have as close to the same number of letters as possible.

N	E	V	A	D	A
---	---	---	---	---	---

M	O	N	T	A	N	A
---	---	---	---	---	---	---

V	I	R	G	I	N	I	A
---	---	---	---	---	---	---	---

W	I	S	C	O	N	S	I	N
---	---	---	---	---	---	---	---	---

M	I	N	N	E	S	O	T	A
---	---	---	---	---	---	---	---	---

N	E	V	A	D	A	A
---	---	---	---	---	---	---

M	O	N	T	A	N	A	N
---	---	---	---	---	---	---	---

V	I	R	G	I	N	I	A
---	---	---	---	---	---	---	---

W	I	S	C	O	N	S	I
---	---	---	---	---	---	---	---

M	I	N	N	E	S	O	T
---	---	---	---	---	---	---	---

The mean in this example is a little less than eight because all the rows except one contain eight letters.

What is the mean of the numbers of letters in the names of the nine states?

1. Write each letter of Massachusetts in a square on a strip of graph paper. Add this to the data for the other nine states. Then repeat the steps to find the median, mode, and mean of the numbers of letters in the names of the ten states.

The median is _____. The mode is _____. The mean is _____.

2. Compare these averages with those for the original nine states. Describe how the addition of Massachusetts affected each average and explain the differences.

3. Remove the data for Massachusetts. Write the names Maryland, Michigan, and Oklahoma on strips of graph paper. Add them to the data for the original nine states. Then repeat the steps to find the median, mode, and mean.

The median is _____. The mode is _____. The mean is _____.

4. Compare these averages with those for the original nine states. Describe how these additions affected each average and explain the differences.

5. To find the mean of the numbers of letters in the names of N states, the letters making up the names of the states must be separated into N sets with the same (or nearly the same) number of letters in each set. Explain how you could find the number of letters in each set without writing each letter on a square.

WHICH WOULD YOU USE?

Sam Slugger's contract with the Columbus Mudcats baseball team says his annual salary will be \$1,000,000 times the *average* of his batting averages for the preceding five seasons. Sam's batting averages for the past five seasons were .145, .130, .160, .130, and .495.

1. If you were Sam, which *average*—mean, median, or mode—would you want to use to compute your salary? Why?
2. If you were the owner of the Mudcats, which *average* would you want to use? Why?
3. Sam's contract went to arbitration. You are the arbitrator. Which *average* would you use to determine Sam's salary? How would you justify your decision?

IDENTIFY THE AVERAGE

Which *average*—mean, median, or mode—do you think was used in each of the following statements? Explain your choice in each case.

The *average* lady's shoe size is $7\frac{1}{2}$.

The *average* size of a household in the United States is 2.64 people.

The *average* annual family income in the United States is \$40,611.