Tuesday, October 10, 2017
7:37 PM

Statistics Honors – Standard Deviation Day 3 KEY

Classwork

1. SAT Math scores in recent years have had ***means*** around 490 and ***standard deviations*** around 100. What is the ***variance*** of SAT Math scores?

$s^2 = (100)2 =$ 10,000

variance = s^2
Std. deviation = s

2. Six ninth-grade students and six 12th-grade students were asked:

How many movies have you seen this month?

Here are their responses:

Ninth-grade students:	5	1	2	5	3	8
12th-grade students:	4	2	0	2	3	1

a. Calculate the mean, variance, and standard deviation of each of these data sets. [Show ALL work using tables]

$s = \sqrt{\frac{1}{n-1}\sum(x_i-\bar{x})^2}$

$\bar{x} = \frac{\sum x_i}{n}$

$\bar{x} = \frac{24}{6}$

$\bar{x} = 4$

Ninth-grade students:

x_i	$x_i - \bar{x}$	$(x_i-\bar{x})^2$
5	1	1
1	-3	9
2	-2	4
5	1	1
3	-1	1
8	4	16
	0	32

$s^2 = \frac{1}{5}(32) = 6.4$ | $s = \sqrt{6.4} = 2.5298$

Twelfth-grade students:

x_i	$x_i - \bar{x}$	$(x_i-\bar{x})^2$
4	2	4
2	0	0
0	-2	4
2	0	0
3	1	1
1	-1	1
	0	10

$\bar{x} = \frac{12}{6}$

$\bar{x} = 2$

$s^2 = \frac{1}{5}(10) = 2$ | $s = \sqrt{2} = 1.4142$

b. Which is more spread out, the ninth-grade or 12th-grade data set? **Justify your reasoning.**

The data for the ninth-graders is more spread out. because the standard deviation is larger.

c. Using your graphing calculator, **just look at** a side-by-side boxplot of ninth-grade and 12-grade data sets. Which of these data sets appears more spread out?

The ninth-graders' data appears shifted to the right and more spread out compared to the 12th-graders' data.

d. Does your answer agree with your conclusion in part (a)? YES.

CLASS NOTES:

3. Suppose we add 2 to each of the numbers in the ninth-grade data in question #2.

That modification produces the following data: 7 3 4 7 5 10

a. Find the ***mean*** and ***the standard deviation*** of the modified data.

$$\bar{x} = \frac{7+3+4+7+5+10}{6} = 6$$

$s^2 = \frac{1}{n-1}\Sigma(x_i-\bar{x})^2 = \frac{1}{5}(32) = 6.4$

$s = \sqrt{\frac{1}{n-1}\Sigma(x_i-\bar{x})^2} = \sqrt{6.4} = 2.5298$

L1 L2=L1-6 L3=L2^2

x_i	$x_i-\bar{x}$	$(x_i-\bar{x})^2$
7	1	1
3	-3	9
4	-2	4
7	1	1
5	-1	1
10	4	16
sum	0	32

b. Compare your answers from (a) with the ***mean*** and ***standard deviation*** from the original ninth-graders' data in question #2.

The mean increased by 2, the same amount that was added to the ninth-graders' data.

How did it change the ***standard deviation***?

The standard deviation stayed the same. why?

c. Without doing the calculations, guess what will happen to the ***mean*** and ***standard deviation*** of the 12th-graders' data from question #2 if we add 10 to each data value.

If you add 10 to each of the numbers in the ninth-grade data set, the mean will increase by 10.

However, the standard deviation will still be 2.53.

d. Write a statement about how adding the same number to each value in a data set affects the ***mean*** and ***the standard deviation***.

Adding the same number to each data set increases the mean by the number you added.

Adding the same number to each data set does not change the standard deviation.

4. Suppose we multiply by 2 to each of the numbers in the 12th-grade data in question #2.

That modification produces the following data: 8 4 0 4 6 2

a. Find the ***mean*** and ***the standard deviation*** of the modified data.

$$\bar{x} = \frac{8+4+0+4+6+2}{6} = 4$$

$$s^2 = \frac{(8-4)^2 + (4-4)^2 + (0-4)^2 + (4-4)^2 + (6-4)^2 + (2-4)^2}{6-1}$$

$$s = \sqrt{8} \approx 2.828$$

b. Compare your answers from (a) with the ***mean*** and ***standard deviation*** from the original 12-graders' data in question #2.

How did multiplying by 2 to each data value change the ***mean***?

The mean was multiplied by 2.

How did multiplying by 2 change the ***standard deviation***?

The standard deviation as multiplied by 2.

c. Without doing the calculations, guess what will happen to the ***mean*** and ***standard deviation*** of the ninth-graders' data from question #2 if we multiply by 10 to each data value.

The mean will be multiplied by 10 and the standard deviation will be multiplied by 10.

d. Write a statement about how multiplying by the same number to each value in a data set affects the ***mean*** and ***the standard deviation***.

Multiplying by the same number to each data set causes the mean to be multiplied by that same number. Multiplying by the same number to each data set causes the standard deviation to be multiplied by that same number.