ST. JEAN DE BREBEUF MATHEMATICS

CHAPTER 3.5

MEASURES OF SPREAD

CABILAN MATH ONLINE.COM

CHAPTER 3.5 MEASURES OF SPREAD

KEY CONCEPTS

Several quantities can be used to measure the spread in a set of data.

The **range** is the difference between the greatest and least values in a set of data.
→To calculate the range, subtract the *least* value from the *greatest* value.

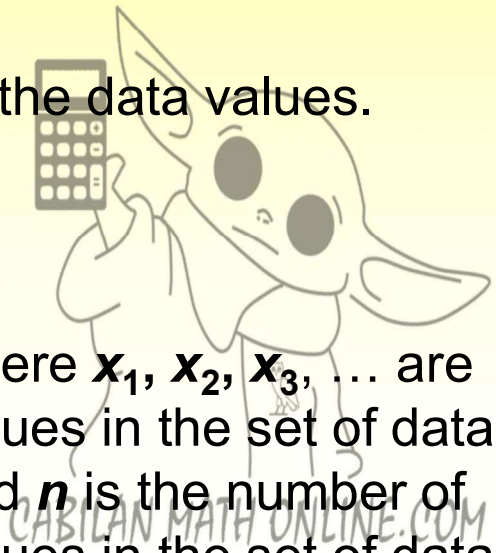
The **variance** is a measure of how spread out the values in a set of data are from the mean.
→The *greater* the variance, the *greater* the spread of the data values.

FORMULA FOR VARIANCE:

$$Variance = \frac{Sum\ of\ (difference\ from\ the\ Mean)^2}{Number\ of\ values\ in\ the\ set\ of\ data}$$

$$Variance = \frac{(x_1 - Mean)^2 + (x_2 - Mean)^2 + ... + (x_n - Mean)^2}{n}$$

where x_1, x_2, x_3, … are values in the set of data, and n is the number of values in the set of data.



CHAPTER 3.5 MEASURES OF SPREAD

KEY CONCEPTS

The **variance** is a measure of how spread out the values in a set of data are from the mean.
→The *greater* the variance, the *greater* the spread of the data values.

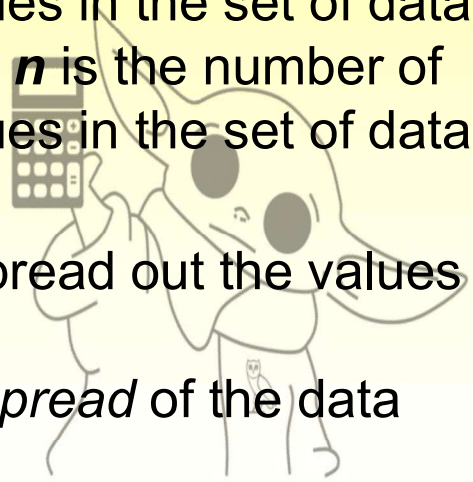
FORMULA FOR VARIANCE:

$$Variance = \frac{Sum\,of\ (difference\ from\ the\ Mean)^2}{Number\ of\ values\ in\ the\ set\ of\ data}$$

$$Variance = \frac{(x_1 - Mean)^2 + (x_2 - Mean)^2 + ... + (x_n - Mean)^2}{n}$$

where x_1, x_2, x_3, … are values in the set of data, and n is the number of values in the set of data.

The **standard deviation** is another measure of how spread out the values in a set of data are from the mean.
→The *greater* the standard deviation, the greater the *spread* of the data values.



FORMULA FOR STANDARD DEVIATION: $Standard\ deviation = \sqrt{Variance}$

CHAPTER 3.5 MEASURES OF SPREAD

KEY CONCEPTS

Quartiles are three values that divide a set of data into four intervals with *equal* numbers of data.

The **interquartile range** measures how closely data clusters around the *median*.

CHAPTER 3.5 MEASURES OF SPREAD

EXAMPLE 1 *Quartiles and Interquartile Ranges*

Iris works part-time selling cell phones. She recorded the numbers of cell phones she sold each month for the last 12 months.

51, 17, 25, 39, 7, 49, 62, 41, 20, 6, 43, 13

(a) Order the data from **least to greatest**

6 7 13 17 20 25 39 41 43 49 51 62

There are **12** pieces of data

(b) Calculate the **median**

Since there as an even number of data
→ Find the **mean** of the two middle values

$$Median = \frac{25+39}{2}$$

$$Median = \frac{64}{2}$$

$$Median = 32$$

The median number of cell phones sold is **32**.

CABILAN MATH ONLINE.COM

CHAPTER 3.5 MEASURES OF SPREAD

EXAMPLE 1 *Quartiles and Interquartile Ranges*

Iris works part-time selling cell phones. She recorded the numbers of cell phones she sold each month for the last 12 months.

Order the data from **least to greatest**

6 7 13 17 20 25 39 41 43 49 51 62

(c) Calculate the **first quartile (Q1)** by finding the *median* of the lower half of the data

$$Q1 = \frac{13+17}{2}$$

$$Q1 = \frac{30}{2}$$

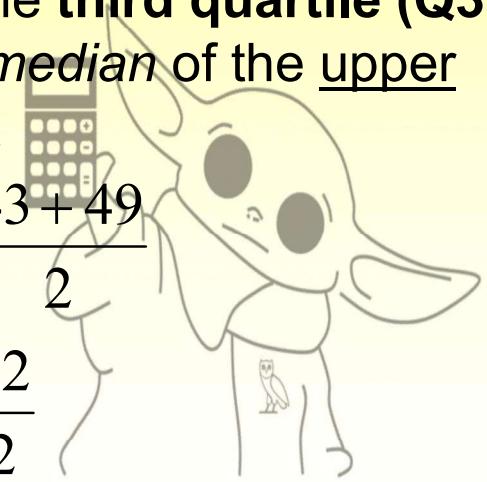
$$Q1 = 15$$

(d) Calculate the **third quartile (Q3)** by finding the *median* of the upper half of the data

$$Q3 = \frac{43+49}{2}$$

$$Q3 = \frac{92}{2}$$

$$Q3 = 46$$



CHAPTER 3.5 MEASURES OF SPREAD

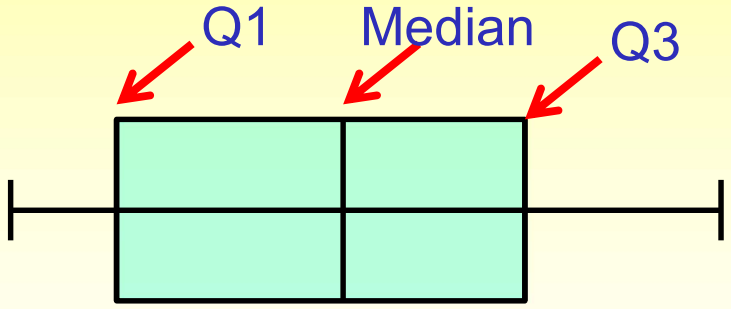
EXAMPLE 1 *Quartiles and Interquartile Ranges*

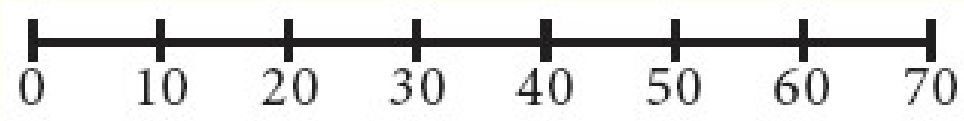
Minimum Maximum

6 7 13 17 20 25 39 41 43 49 51 62

$Median = 32$ | $Q1 = 15$ | $Q3 = 46$

(e) Display the data in a **box-and-whisker plot** (use the number line as a guide)





DRAWING BOX-AND-WHISKER PLOTS

→Draw **short vertical lines** at the minimum value and the maximum value

→Draw a **horizontal line segment** connecting the minimum and maximum values

→Draw a **longer vertical line segment** at the **first quartile**, the **median** and the **third quartile**

→Join the vertical segments to form a box.

CHAPTER 3.5 MEASURES OF SPREAD

EXAMPLE 2 *Range, Variance and Standard Deviation*

Carmella's monthly gasoline expenses, in dollars, for the past year are shown.

61, 83, 77, 88, 67, 71, 65, 72, 67, 84, 90, 80

There are **12** sets of data

(a) Calculate the **range** (to the nearest dollar)

Range = highest value – lowest value

= 90 – 61

= $29

The range is **$29**

(b) Calculate the **mean** (to the nearest dollar)

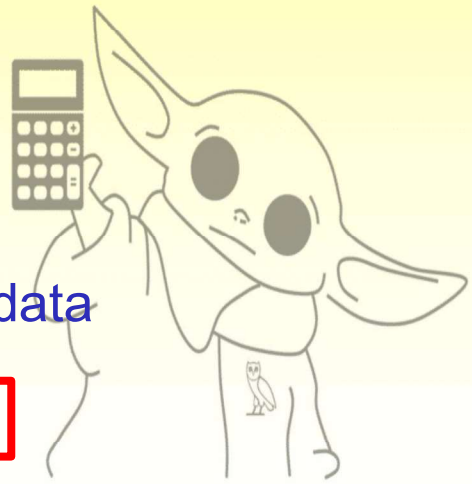
Add up the data and divide by the number of data

$$Mean = \frac{61+83+77+\ldots+90+80}{12}$$

$$Mean = \frac{905}{12}$$

$$Mean = \$75$$

The mean price for gas is **$75**



CHAPTER 3.5 MEASURES OF SPREAD

EXAMPLE 2 *Range, Variance and Standard Deviation*

(c) Complete the table to calculate the **variance** (to the nearest dollar) (from (b), **mean = $75**)

AMOUNT	AMOUNT – MEAN	(DIFFERENCE FROM MEAN)^2	VALUE OF (DIFFERENCE FROM MEAN)^2
61	61 – 75	$(-14)^2$	196
83	83 – 75	$(8)^2$	64
77	77 – 75	$(2)^2$	4
88	88 – 75	$(13)^2$	169
67	67 – 75	$(-8)^2$	64
71	71 – 75	$(-4)^2$	16
65	65 – 75	$(-10)^2$	100
72	72 – 75	$(-3)^2$	9
67	67 – 75	$(-8)^2$	64
84	84 – 75	$(9)^2$	81
90	90 – 75	$(15)^2$	225
80	80 – 75	$(5)^2$	25
TOTAL (SUM OF [DIFFERENCE FROM MEAN]^2)			1017

CHAPTER 3.5 MEASURES OF SPREAD

EXAMPLE 2 *Range, Variance and Standard Deviation*

(c) Complete the table to calculate the **variance** (to the nearest dollar) (from (b), **mean = $75**)

TOTAL (SUM OF [DIFFERENCE FROM MEAN]²)	1017

$$Variance = \frac{Sum\,of\ (difference\ from\ the\ Mean)^2}{Number\ of\ values\ in\ the\ set\ of\ data}$$

$$Variance = \frac{(x_1 - Mean)^2 + (x_2 - Mean)^2 + ... + (x_n - Mean)^2}{n}$$

$$Variance = \frac{(61-75)^2 + (83-75)^2 + ... + (80-75)^2}{12}$$

$$Variance = \frac{1017}{12}$$

The variance is **$85**

$$Variance = \$85$$

CABILAN MATH ONLINE.COM

CHAPTER 3.5 MEASURES OF SPREAD

EXAMPLE 2 *Range, Variance and Standard Deviation*

$$Variance = \$85$$

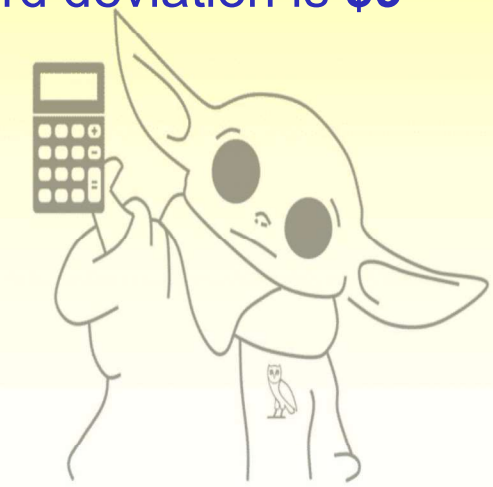
(d) Calculate the **standard deviation** (to the nearest dollar)

$$S\tan dard\ deviation = \sqrt{Variance}$$

$$S\tan dard\ deviation = \sqrt{85}$$

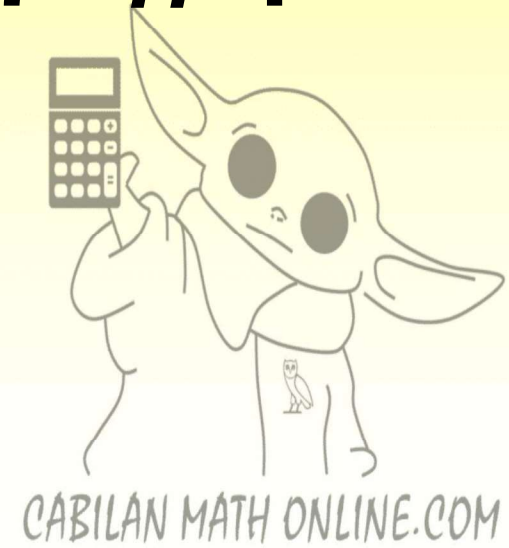
$$S\tan dard\ deviation = \$9$$

The standard deviation is **$9**



CABILAN MATH ONLINE.COM

CHAPTER 3.5 MEASURES OF SPREAD

Homework

Page 145 – 147 #1 – 10, 12