Statistics – Measures of Variation

– **measures of variance** → represents how spread out or scattered a set of data is.

- range – represents the difference between the greatest and least values
- variance (σ^2) – (r^2)
- standard deviation (σ) – (r)

} indicates how much the data values differ from the mean

Variance "Formula" → $\sigma^2 = \dfrac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \ldots + (x_n - \bar{x})^2}{n}$ where $\bar{x}$ = mean

Standard Deviation "Formula" → $\sigma = \sqrt{\dfrac{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + \ldots + (x_n - \bar{x})^2}{n}}$ where $\bar{x}$ = mean

Example 1: The table shows the population in millions of 11 eastern states of the 2000 Census.

State	Population	State	Population	State	Population
NY	19.0	MD	5.3	RI	1.0
PA	12.3	CT	3.4	DE	0.8
NJ	8.4	ME	1.3	VT	0.6
MA	6.3	NH	1.2	—	—

a.) Find the range and the mean of the population:

range = $19 - .6 = \boxed{18.4}$ mean = $\dfrac{19+12.3+8.4+6.3+5.3+3.4+1.3+1.2+1+.8+.6}{11} = \dfrac{59.6}{11}$

$\boxed{\bar{x} = 5.4}$

b.) Find the variance of the population:

$r^2 = \dfrac{(19-5.4)^2+(12.3-5.4)^2+(8.4-5.4)^2+(6.3-5.4)^2+(5.3-5.4)^2+(3.4-5.4)^2+(1.3-5.4)^2+(1.2-5.4)^2+(1-5.4)^2+(.8-5.4)^2+(.6-5.4)^2}{11} = \dfrac{344.4}{11}$

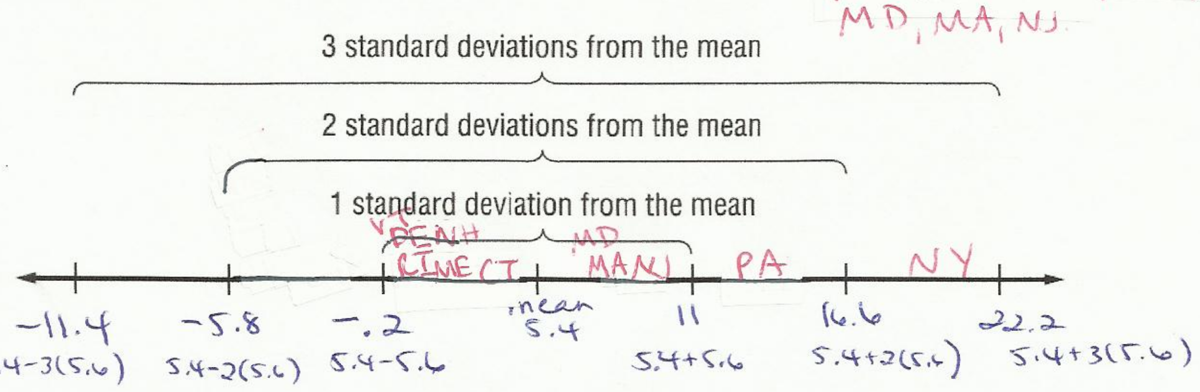
$\boxed{r^2 = 31.3}$

c.) Find the standard deviation of the population: $\sqrt{r^2} = \sqrt{31.3} \rightarrow \boxed{r = 5.6}$

$\searrow r = ?$

d.) Complete the visual representation of the standard deviation from the mean:

Which states fell within one standard deviation from the mean? VT, DE, NH, RI, ME, CT, MD, MA, NJ



Calculator Steps to Find a set of One-Variable Statistics

1.) Press **STAT** then **ENTER** and "enter in" the list of given data

2.) Press **STAT** ▶ then press 1 (to calculator 1-Var Stats) and press **ENTER**

3.) A list of information will show up on your screen (make sure to scroll down to see more info…) – The ones that will be the most important to you are the following:

$\bar{x}$ = mean ; Σx = Sum of values (numerator for finding mean) ; σx = Standard deviation

n = # of data items ; min X = least value ; max X = greatest value

Example 2: Use the weights in pounds of the starting offensive lineman of the football teams from three high schools.

Jackson	Washington	King
170, 165, 140, 188, 195	144, 177, 215, 225, 197	166, 175, 196, 206, 219

a.) Find the standard deviation of each high school:

σ x for Jackson HS = 19.3 ; σ x for Washington HS = 28.9 ; σ x for King HS = 19.5

b.) Which team had the most variation in weights? Washington HS (largest std dev.)

How do you think this variation will impact their play? if everyone plays – could definitely help but if one of bigger weight players gets hurt then may not help them b/c variation # will lower.

Example 3: Use the frequency table that shows the scores on a multiple-choice test.

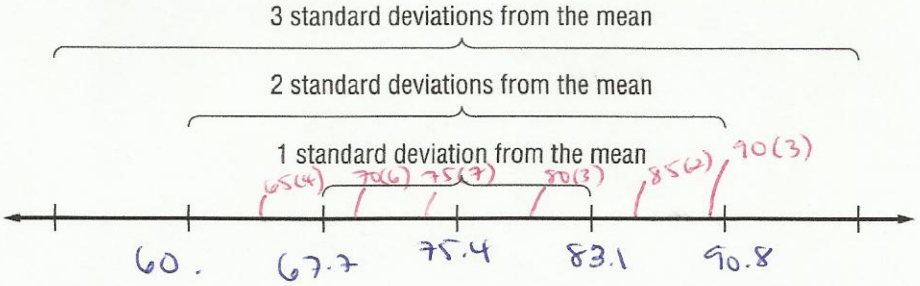
Score	Frequency
90	3
85	2
80	3
75	7
70	6
65	4
	25 total #'s

$\bar{x} = 75.4$

a.) Find the variation and standard deviation of the scores:

variation = $(7.7)^2 = 59.3$ (rx^2) standard deviation = 7.7 (rx)

b.) Create a visual representation of mean and the standard deviation:



c.) What percent of the scores are within one standard deviation from the mean? $\frac{16}{25} = \boxed{64\%}$

d.) What percent of the scores are within two standard deviations from the mean? $\frac{25}{25} = \boxed{100\%}$