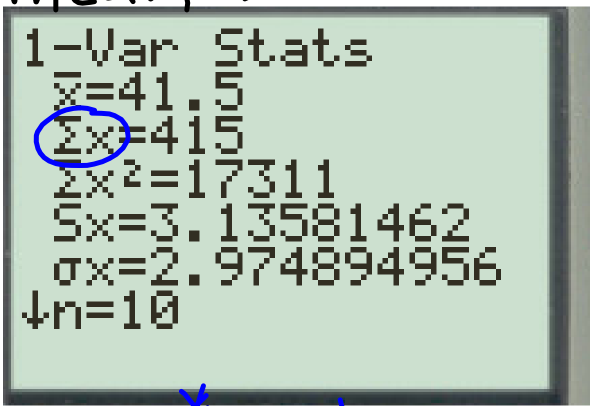
Measures of Variation

I. Range

$41,500

II. Deviation

Mean $\bar{x} = 41.5$



St. dev. *sample 3.1 3,100

pop. 2.97

Starting Salary for Corporation A

Salary (in thousands $)	Deviation
41 41,000	
38	
39	
45	
47	
41	
44	
41	
37	
42	
$\sum x =$ 415	$\sum(x-\mu) =$

III. Population

a. Variance

b. Standard Deviation

In words:

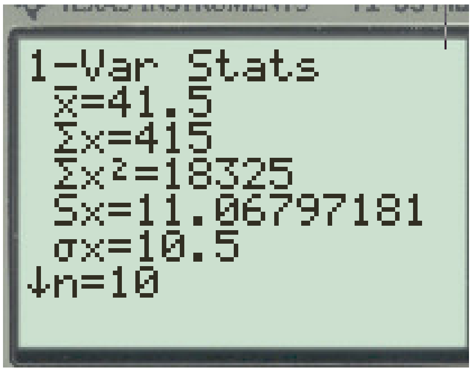
1. Find the mean of the population data set.
2. Find the deviation of each entry.
3. Square each deviation.
4. Add to get the *sum of squares*.
5. Divide by *n* to get the *population variance*.
6. Find the square root of the variance to get the *population standard deviation*.

In symbols:

9

Starting Salaries for a sample of Corporation B (1000s of dollars)

Salary	**40**	**23**	**41**	**50**	**49**	**32**	**41**	**29**	**52**	**58**



Mean $\bar{x} = 41.5$

\$41,500

St. dev = 11.1

\$11,100

10

Measures of Variation

IV. **Sample**

a. **Variance**

b. **Standard Deviation**

In words:

In symbols:

1. Find the mean of the sample data set.
2. Find the deviation of each entry.
3. Square each deviation.
4. Add to get the *sum of squares*.
5. Divide by *n* to get the *sample variance*.
6. Find the square root of the variance to get the *sample standard deviation*.

Starting Salaries for a sample of Corporation B (1000s of dollars)

Salary	**40**	**23**	**41**	**50**	**49**	**32**	**41**	**29**	**52**	**58**

V. Interpreting Standard Deviation

Analyze the graphs on top of page 73.

The more the entries are spread out, the ______________________ the standard deviation.

Dec 2-9:30 AM

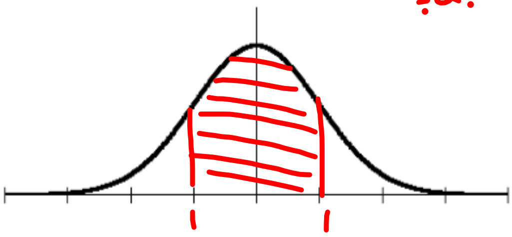
Measures of Variation

Empirical Rule (or 68-95-99.7 Rule)

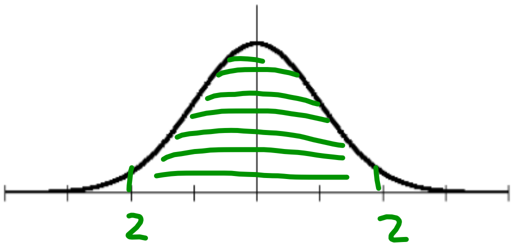
For data with a (symmetrical) bell-shaped distribution, the standard deviation has the following characteristics.

1. **About** 68% **of the data lies within** 1 σ **of the** μ.

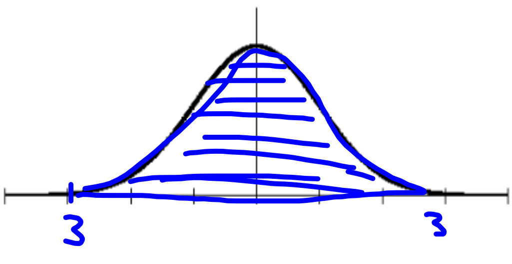
sd. mean



2. **About** 95% **of the data lies within** 2 σ **of the** μ.



3. **About** 99.7% **of the data lies within** 3 σ **of the** μ.

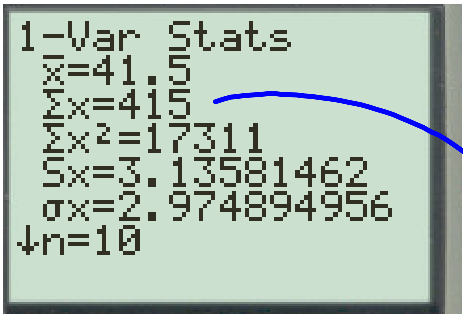


$$\begin{array}{r} 100\% \\ -\ 99.7\% \\ \hline .3\% \end{array}$$

$.3\% / 2 = .15\%$

Measures of Variation

I. Range



Mean
$\bar{x} = 41.5$
\$41,500

Standard deviation
Sample : 3.1 \$3,100
Pop. = 2.97
≈ 3.0

Starting Salary for Corporation A

Salary (in thousands \$)	Deviation
41	
38	
39	
45	
47	
41	
44	
41	
37	
42	
$\sum x =$ 415	$\sum (x - \mu) =$

III. Population

a. Variance

b. Standard Deviation

In words:

1. Find the mean of the population data set.
2. Find the deviation of each entry.
3. Square each deviation.
4. Add to get the *sum of squares*.
5. Divide by *n* to get the *population variance*.
6. Find the square root of the variance to get the *population standard deviation*.

In symbols:

Measures of Variation

IV. Sample

a. Variance **b. Standard Deviation**

In words: **In symbols:**

1. Find the mean of the sample data set.
2. Find the deviation of each entry.
3. Square each deviation.
4. Add to get the *sum of squares*.
5. Divide by n to get the *sample variance*.
6. Find the square root of the variance to get the *sample standard deviation*.

Starting Salaries for a sample of Corporation B (1000s of dollars)

Salary	**40**	**23**	**41**	**50**	**49**	**32**	**41**	**29**	**52**	**58**

V. Interpreting Standard Deviation

Analyze the graphs on top of page 73.

The more the entries are spread out, the ______________________ the standard deviation.

1-Var Stats
$\bar{x}=41.5$
$\Sigma x=415$
$\Sigma x^2=17311$
$Sx=3.13581462$
$\sigma x=2.974894956$
↓n=10

Mean
$\bar{x} = 41.5$
$41,500

Standard deviation

Sample: 3.1 $3,100

Pop. = 2.97
≈ 3.0

Starting Salary for Corporation A

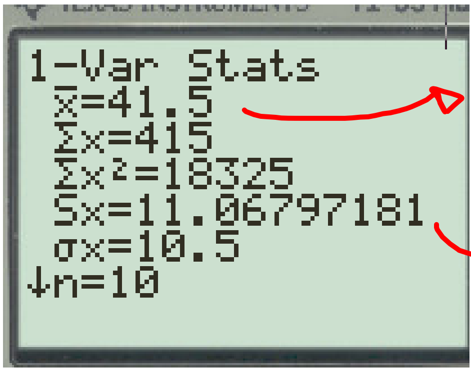
Salary (in thousands $)	Deviation
41	
38	
39	
45	
47	
41	
44	
41	
37	
42	
$\sum x =$ 415	$\sum (x - \mu) =$

III. **Population**

10

Starting Salaries for a sample of Corporation B (1000s of dollars)

Salary	**40**	**23**	**41**	**50**	**49**	**32**	**41**	**29**	**52**	**58**



mean $\bar{x} = 41.5$ \$41,500

s.d. $= 11.07$

≈ 11.1 \$11,100

21

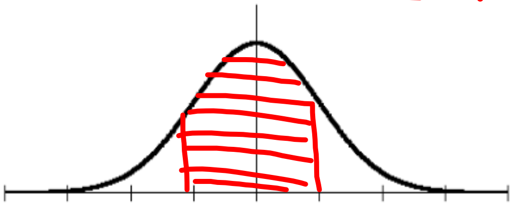
Measures of Variation

Empirical Rule (or 68-95-99.7 Rule)

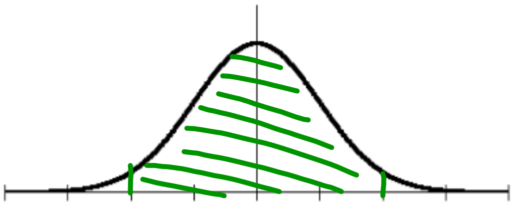
For data with a (symmetrical) bell-shaped distribution, the standard deviation has the following characteristics.

1. **About** 68% **of the data lies within** 1 σ **of the** μ.

   s.d. mean

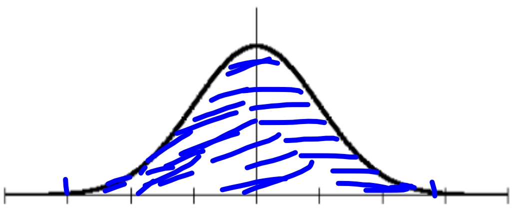


2. **About** 95% **of the data lies within** 2 σ **of the** μ.



3. **About** 99.7% **of the data lies within** 3 σ **of the** μ.

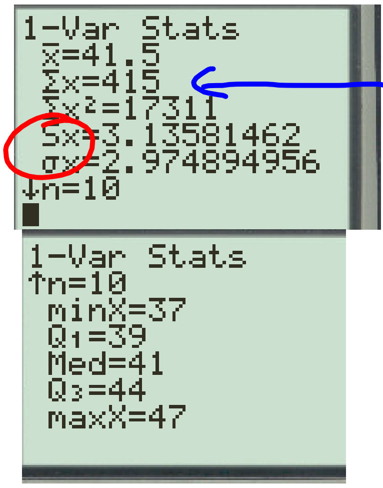
$$\begin{array}{r} 100.0 \\ 99.7 \\ \hline .3 \end{array} \qquad .3/2 = .15$$



Measures of Variation

I. Range

II. Deviation



Starting Salary for Corporation A

Salary (in thousands $)	**Deviation**
41	415 - 41
38	415 - 38
39	415 - 39
45	⋮
47	
41	
44	
41	
37	
42	
$\sum x =$ 415	$\sum (x-\mu) =$

III. Population

a. Variance $V = (3.14)^2$

$V = 9.85$

b. Standard Deviation

3.14

In words:

1. Find the mean of the population data set.
2. Find the deviation of each entry.
3. Square each deviation.
4. Add to get the *sum of squares*.
5. Divide by *n* to get the *population variance*.
6. Find the square root of the variance to get the *population standard deviation*.

In symbols:

Measures of Variation

IV. Sample

a. Variance **b. Standard Deviation**

In words: **In symbols:**

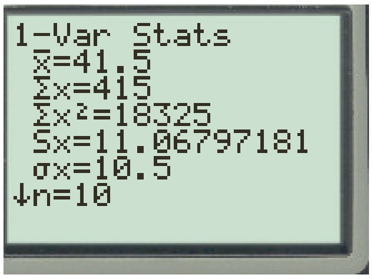
1. Find the mean of the sample data set.
2. Find the deviation of each entry.
3. Square each deviation.
4. Add to get the *sum of squares*.
5. Divide by *n* to get the *sample variance*.
6. Find the square root of the variance to get the *sample standard deviation*.

Starting Salaries for a sample of Corporation B (1000s of dollars)

Salary	**40**	**23**	**41**	**50**	**49**	**32**	**41**	**29**	**52**	**58**

Mean: 41.5 $41,500

s.d = 11.07 $11,000



V. Interpreting Standard Deviation

Analyze the graphs on top of page 73.

The more the entries are spread out, the ____________________ the standard deviation.

Measures of Variation

Empirical Rule (or 68-95-99.7 Rule)

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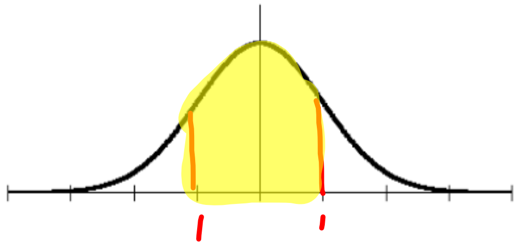
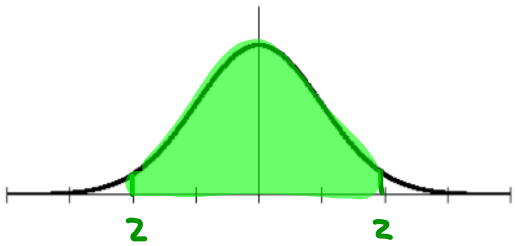
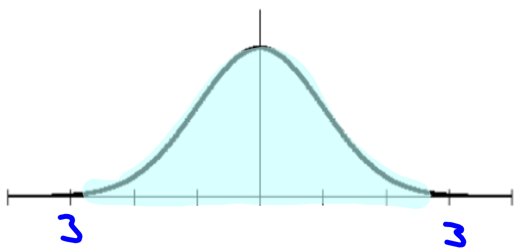


2. **About** 95% **of the data lies within** 2 σ **of the** μ.



3. **About** 99% **of the data lies within** 3 σ **of the** μ.



Measures of Variation

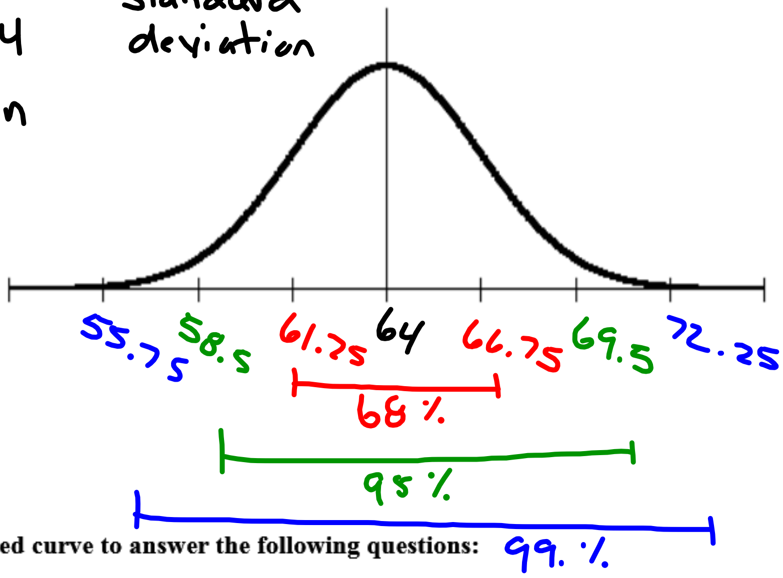
Example:

Suppose you are given that the mean height of American women (ages 20 – 29) was 64 inches with a standard deviation of 2.75 inches. Draw and label the bell-shaped (normal) distribution curve.

$N(64, 2.75)$

s.d. = 2.75
standard deviation

$\bar{x} = 64$
mean



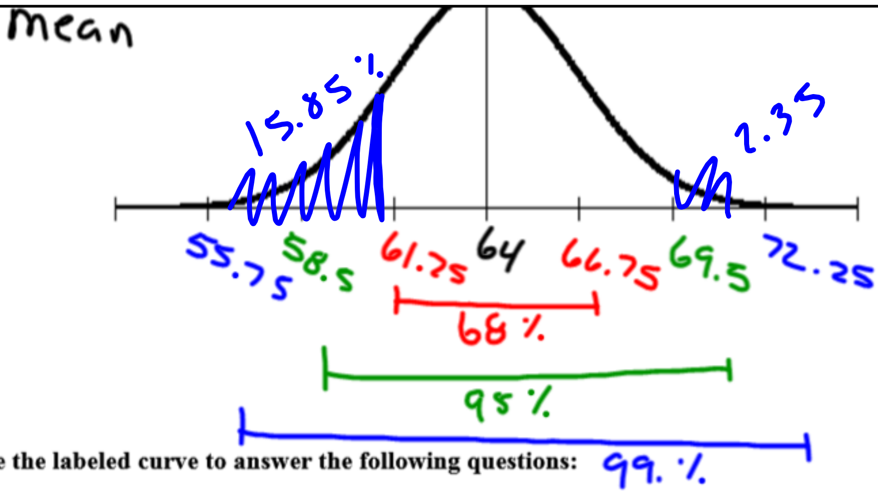
Use the labeled curve to answer the following questions:

1. Estimate the percent of the women whose height are between 61.25 inches and 69.5 inches.

2. Estimate the percent of the women whose height are above 61.25 inches.

3. Estimate the percent of the women whose height are below 58.5 inches.

4. Estimate the percent of the women whose height is either below 61.25 inches OR above 69.5 inches.

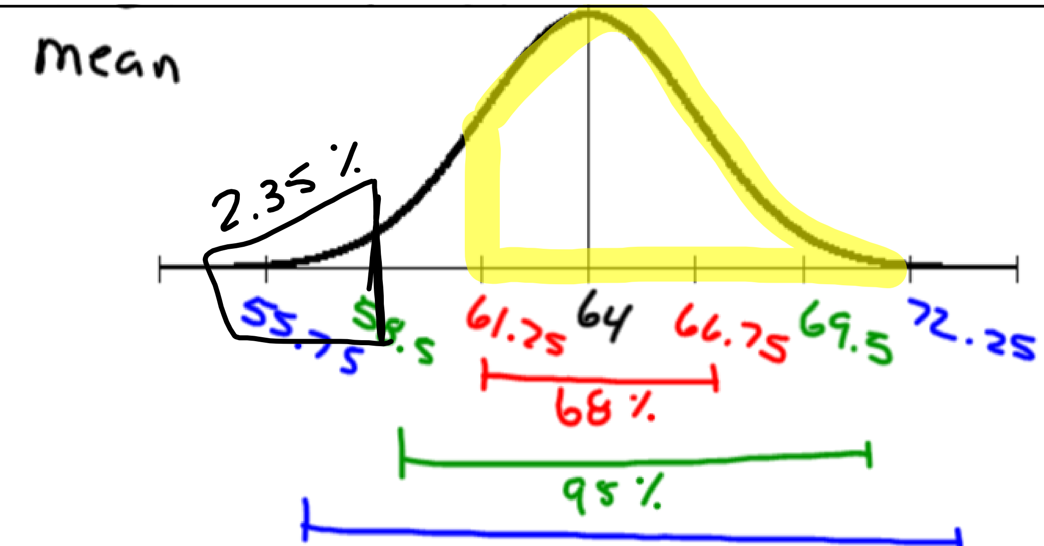


Use the labeled curve to answer the following questions:

1. Estimate the percent of the women whose height are between 61.25 inches and 69.5 inches.
2. Estimate the percent of the women whose height are above 61.25 inches.
3. Estimate the percent of the women whose height are below 58.5 inches.
4. Estimate the percent of the women whose height is either below 61.25 inches OR above 69.5 inches.

15.85 + 2.35 = 18.2%

Dec 2-1:07 PM



Use the labeled curve to answer the following questions:

1. Estimate the percent of the women whose height are between 61.25 inches and 69.5 inches.

   $34 + 34 + 13.5 = 81.5\ \%$

2. Estimate the percent of the women whose height are above 61.25 inches.

   83.85%

3. Estimate the percent of the women whose height are below 58.5 inches.

Dec 2-1:04 PM

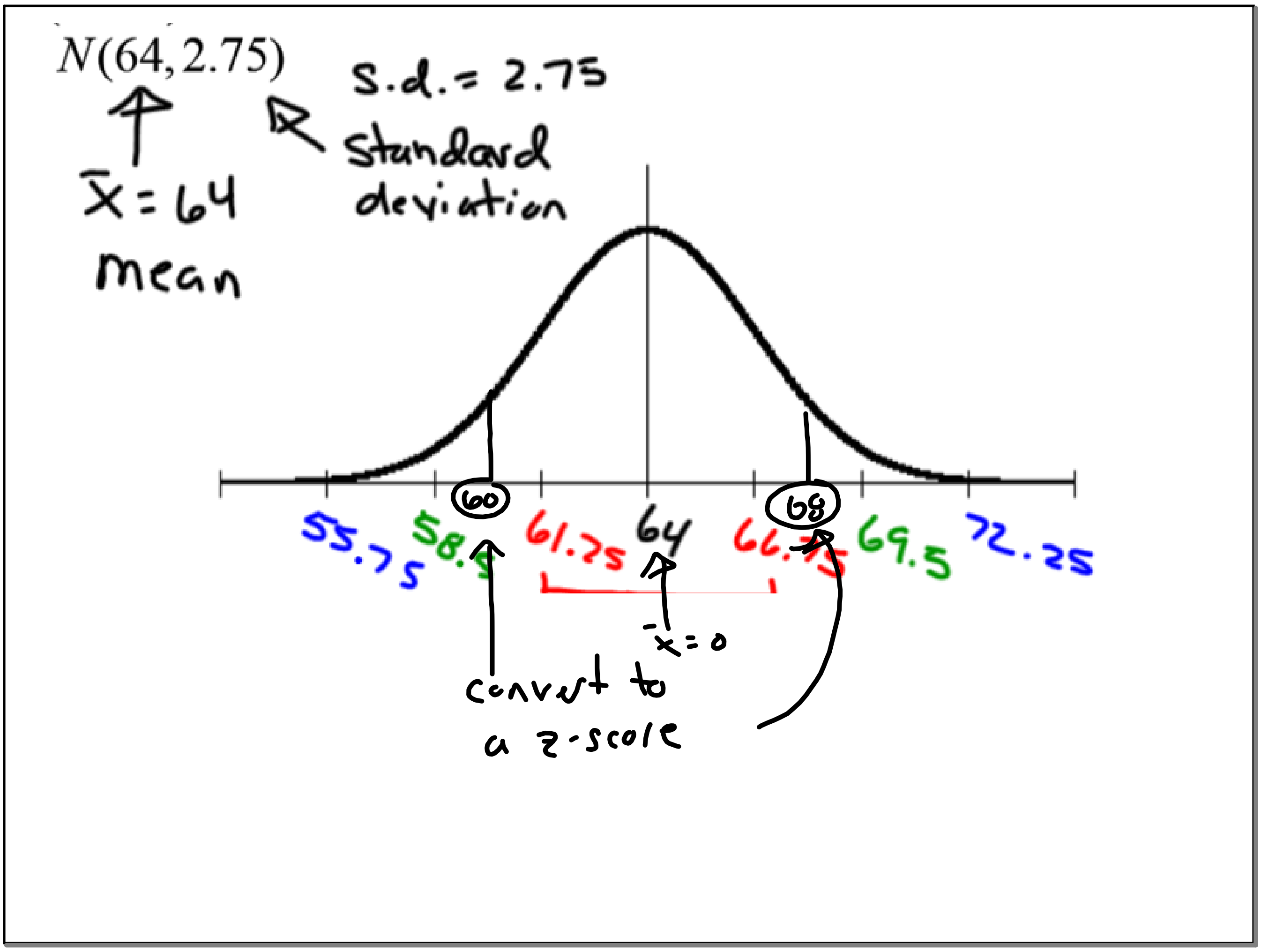
$N(64, 2.75)$

s.d. = 2.75 standard deviation

$\bar{x} = 64$ mean

$34 + 34 + 13.5 = 80.5\%$

Dec 2-9:02 AM


$N(64, 2.75)$
s.d. = 2.75
standard deviation
$\bar{x} = 64$
mean
55.75
58.5
60
61.25
64
66.75
68
69.5
72.25
$\bar{x} = 0$
convert to a z-score

Dec 2-9:01 AM