## Section 3.2

Measures of Dispersion

Range = the difference between the largest value and smallest value

range = (largest value) – (smallest value)

1. Find the range of the following data

   33, 45, 5, 31, 50, 85

Standard Deviation = a measure of variation of values about the mean.

Population Standard Deviation

$$\sigma = \sqrt{\frac{\Sigma(x_i - \mu)^2}{N}}$$

Sample Standard Deviation

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

Shortcut formula for sample standard deviation

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

2. Find the sample standard deviation (by hand and via TI-83/84)

5, 10, 23, 2

## 1-VarStats

1. Input numbers, then "2nd" "mode" to exit out
2. "stat" button, "right arrow" to CALC, "enter" on 1-varstats, "enter"

Note: down arrow to see more results below and up arrow to go back up

## Standard Deviation (TI-83/84)

1. Enter Values Into L1 ("Stat" button – Edit)
2. "2nd" button, "Stat" button
3. Choose "Math"
4. Choose "Stddev"
5. "Enter" button
6. "2nd" button, "1" button
7. ")" button
8. "Enter" button

Variance = a measure of variation equal to the square of the standard deviation.

## Symbols

$s$ = sample standard deviation

$s^2$ = sample variance

$\bar{x}$ = sample mean

$\sigma$ = population standard deviation

$\sigma^2$ = population variance

$\mu$ = population mean

## Note

In comparing two sets of data, the larger the standard deviation, the more dispersion the distribution has

## Round-Off Rule

* Carry one more decimal place than is present in the original set of data.

## Comparing Variation in Different Populations

Coefficient of Variation (CV) = describes the standard deviation relative to the mean, and is given by the following formula:

$$CV = \frac{\text{standard deviation}}{\text{mean}} \cdot 100\%$$

## 3. Find the coefficient of variation given the following:

standard deviation = 2

mean = 10

## Describing the Skewness of a Distribution

This generally lies between -3 and 3. The closer it is to -3, the more it is skewed left, the closer it is to +3, the more it is skewed right. 0 indicates symmetric.

$$\text{Skewness} = \frac{3(\text{mean - median})}{\text{standard deviation}}$$

## 4. Describe the skewness of the following:

mean = 60

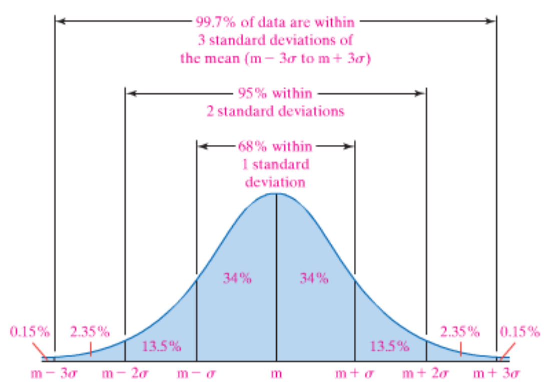
median = 40

standard deviation = 10

Range Rule of Thumb
Std Dev is approximately equal to range / 4
where range = (high value) – (low value)

*min “usual” value = mean – 2 (std dev)
*max “usual” value = mean + 2 (std dev)

Empirical (or 68-95-99.7) Rule for Data with a Bell-Shaped Distribution
* About 68% of all values fall within 1 standard deviation of the mean
* About 95% of all values fall within 2 standard deviations of the mean
* About 99.7% of all values fall within 3 standard deviations of the mean.




## Using Empirical Rule to Determine Percentage

1. Find mean and std. dev. (may have to use 1-VARSTATS)
2. Map the mean and standard deviations to a blank bell graph
3. Add up the appropriate percentages you are wanting to find in a problem

5. Given the mean = 20 and standard deviation is 2, use the empirical rule to find the following:

a) Determine the percentage that falls between 18 and 24, inclusive
b) Determine the percentage that is greater than or equal to 22
c) Determine the percentage that is less than or equal to 16 and greater than or equal to 24

## Note

Finding Actual Percentage in a Range with Raw Data:

1. Count how many are in the range (lets say this is x)
2. Count how many there are total (lets say this is n)
3. Actual Percentage = (x / n) times 100

Chebyshev's Theorem
The proportion of any set of data lying within K standard deviations of the mean is always at least:

$$1-\frac{1}{K^2}$$

Chebyshev's Theorem
* At least ¾ or (75%) of all values lie within 2 standard deviations of the mean
* At least 8/9 (or 89%) of all values lie within 3 standard deviations of the mean

Finding the range of values given mean and standard deviation

$$(\bar{x}-ks) \text{ to } (\bar{x}+ks)$$

$$\text{where k} = \text{number of standard deviations specified}$$