# §3.2 Measures of Spread

Test Scores: 54, 57, 62, 65, 65, 66, 77, 83, 92

(59.5 between 57 and 62; 80 between 77 and 83)

$\bar{x} = 69$ med = 65 Measures of Center

## Measures of Spread

① range = Max − Min = 92 − 54 = 38

② IQR = $Q_3 - Q_1 = 80 - 59.5$

$Q_1$ = first Quartile = Middle of first half $\approx \cancel{62} = 59.5$
= 25th Percentile

$Q_3 = P_{75} \approx \cancel{77} = 80$

③ Standard Deviation = $S_x = S = 12.49$

$\boxed{S = 12.5}$

The average distance from the mean to each of the data values.

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

Always use Calculator

④ Variance = $S^2 = (S_x)^2 = 156 = \frac{1248}{8}$

Do Once by Hand So you understand Where formula Comes from. $\bar{X} = 69$

Always use 1-Var Stats $S = S_x$

| $x$ | $x - 69$<br>$x - \bar{x}$ | $(x - \bar{x})^2$ |
|---|---|---|
| 54 | −15 | 225 |
| 57 | −12 | 144 |
| 62 | −7 | 49 |
| 65 | −4 | 16 |
| 65 | −4 | 16 |
| 66 | −3 | 9 |
| 77 | 8 | 64 |
| 83 | 14 | 196 |
| 92 | 23 | 529 |
| $n = 9$ | 0 | find Average |

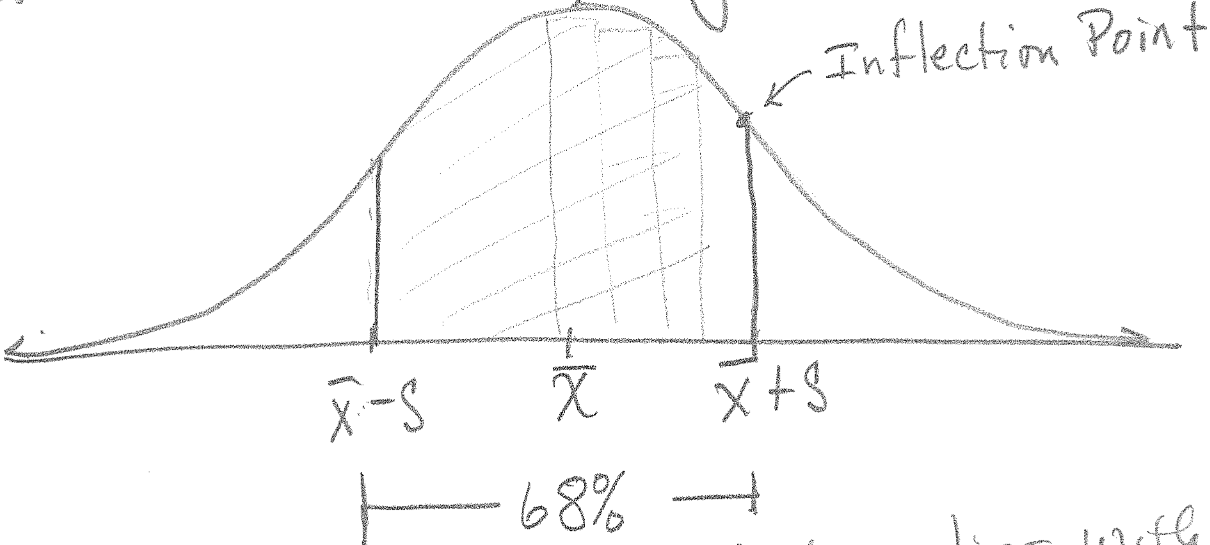
$$\text{Variance} = \frac{\Sigma(x-\bar{x})^2}{n-1} = \frac{1248}{8} = \boxed{156 = \text{Var}}$$

$$S = \sqrt{\text{var}} = \sqrt{1248} = 12.49 \approx \boxed{S = 12.5}$$

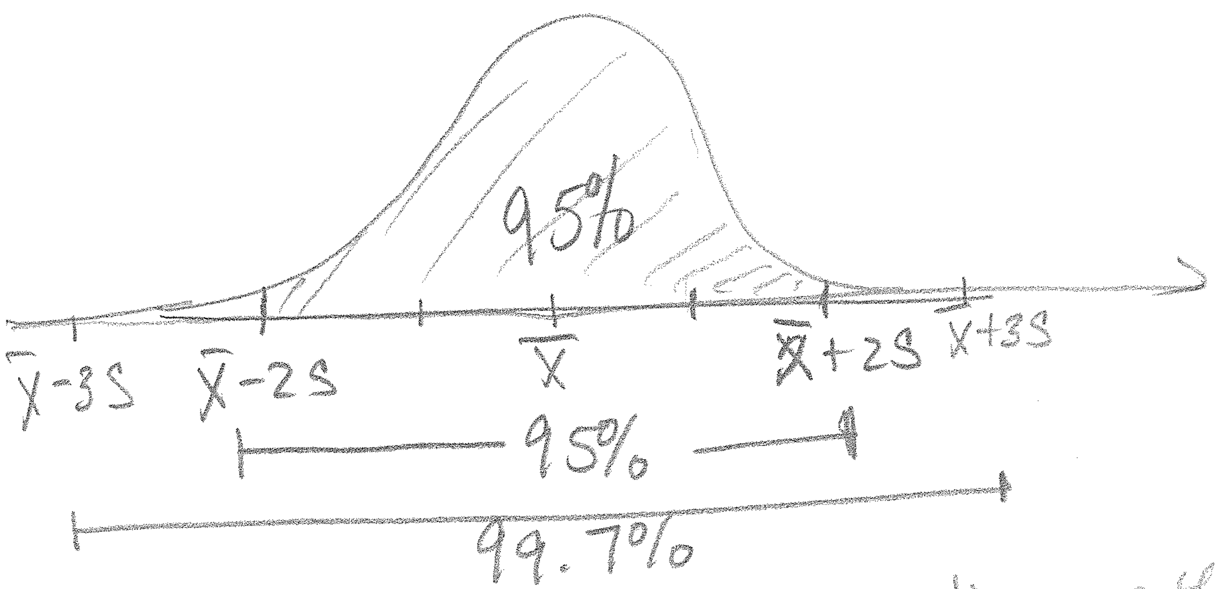
# Empirical Rule

68 - 95 - 99.7 Rule

If Data is Normally Distributed then




68% of a Normal population lies within one Standard deviation of the Mean.




99.7% of population lies within 3 Standard Deviations of the Mean

## Use 1-Var Stats to find $s$ & $s^2$

Var $= S^2$ is Not given by calculator To find

$Var = S_x^2 =$ $\boxed{Vars}$ 5: Statistics 3: $S_x$ $\boxed{Enter}$ $\boxed{X^2}$ Enter

## Height Data for class

$\bar{X} = 66.9$

$S_x = 3.999$

$n = 32$

Min $= 60$

$Q_1 = 64$

Med $= 65.5$

$Q_3 = 71$

Max $= 75$

### Measures of Center

$\bar{X} = 66.9$ Med $= 65.5$ Mode $= 64$

### Measures of Spread

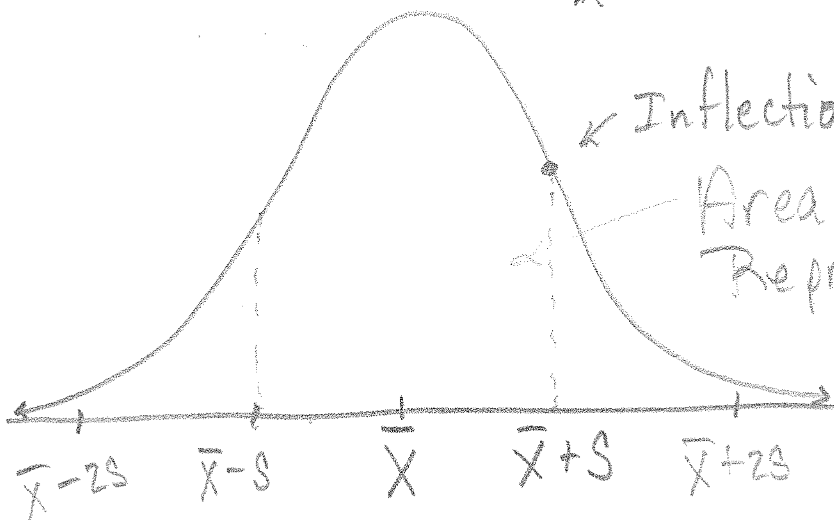
range = Max − Min = 75 − 60 = 15 inches

$S_x = 4.0$ in

$S_x^2 = 16.0 \text{ in}^2$

# Empirical Rule

Data is Normally distributed




Inflection Point

Area under the curve. Represents proportions of the population

Total Area = 100% = 1

68%

95%

99.7%

99.7% of the data will lie within 3 Standard deviations of the Mean.

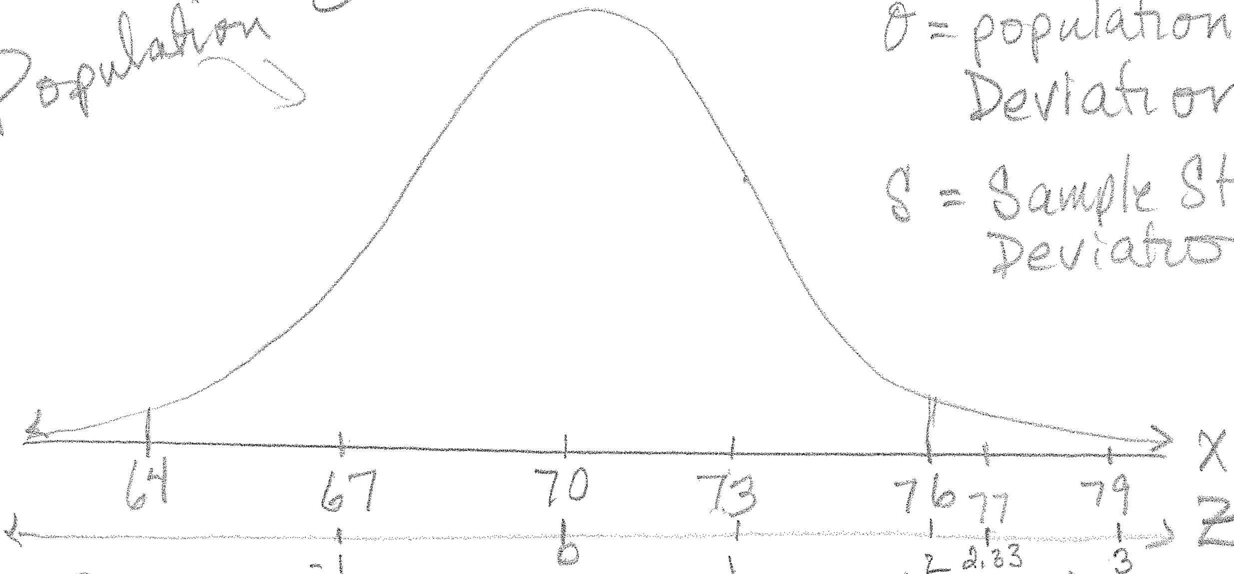
# All Men's Heights

Population

$\mu = 70$ in $\quad \sigma = 3$

$\sigma$ = population Standard Deviation

$s$ = Sample Standard Deviation



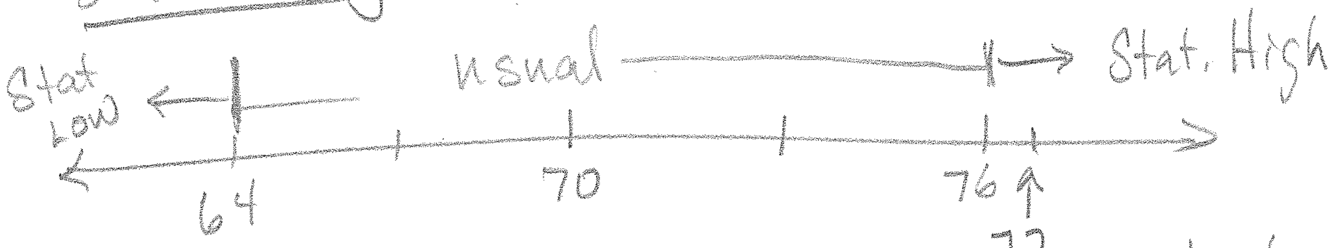

95% of Men are between 64 in & 76 in tall

## Range Rule of thumb

A data Value is statistically Significant if it is more than 2 Standard deviations from the Mean.

Statistically high $\geq \bar{x} + 2s$ = max Usual

Statistically low $\leq \bar{x} - 2s$ = Min Usual




So River's height = 77 = Statistically high

77 is an Outlier