

Panel 1

Least Time:

Short cut formula for variance

$$s^2 = \frac{1}{n-1} \left( \sum x^2 - \frac{(\sum x)^2}{n} \right)$$

Standard deviation  
(Graphical interpretation)  $s = \sqrt{s^2}$

Upper/lower quartiles

$L_1 = 0.25 \cdot N = 2.53$   $Q_1$  is 8<sup>th</sup> #

$L_3 = 0.75 \cdot N = 7.51$   $Q_3$  is 18<sup>th</sup> #

Box plot

put #s in order

0.25 · N = 10  
Between 10<sup>th</sup>  
and 11<sup>th</sup> #

X	X <sup>2</sup>
1	1
5	25
7	49
8	64
<u>21</u>	<u>139</u>

1

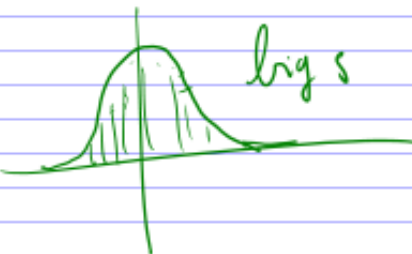
Panel 2

Data: (1, 5, 7, 8) Find  $s^2$ .

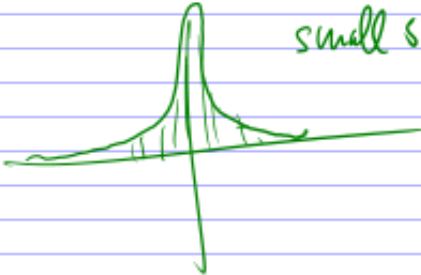
$$s^2 = \frac{1}{3} \left( 139 - \frac{21^2}{4} \right) = 9.583$$

std dev = 3.09

X	X <sup>2</sup>
1	1
5	25
7	49
8	64
<u>21</u>	<u>139</u>



big s

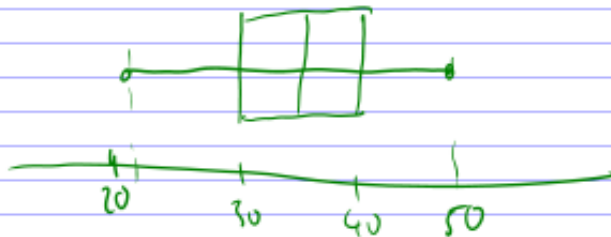


small s

2

Panel 3

Box plot:  $Q_1 = 30$   
 $Q_3 = 40$   
 Median = 35  
 Length = 50  
 Low = 21



3

Panel 4

## Percentiles:

A generalized form of quartiles is Percentiles  
 $n$ -th percentile is # with  $n\%$  less and  
 $(100-n)\%$  bigger than it!

Ex: If your SAT results put you in the  
 95<sup>th</sup>-percentile, what does this mean?  
 Good news: you're in the top 5%!

4

Panel 5

## Finding the $x^{\text{th}}$ -Percentile

Position  $x \cdot N$ , round up as before for quartiles  
Take the number at the corresponding position.

Ex: Suppose exam scores were: 75, 65, 80, 90, 97, 92,  
85, 62, 87, 99, 93, 71, 86. Find 80<sup>th</sup> percentile

$$0.8 \cdot 13 = 10.4 \Rightarrow 11^{\text{th}} \# \text{ is } \underline{\underline{93}}$$

5

Panel 6

## Estimating the Standard Deviation

$S$  is a lot of work to compute.

For a symmetric, bell-shaped distribution you have:

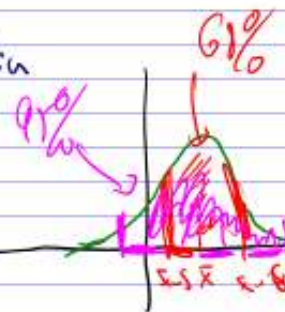
68% of data is between  $\bar{x} - s, \bar{x} + s$

95% of data is between  $\bar{x} - 2s, \bar{x} + 2s$

100% of data is between  $\bar{x} - 3s, \bar{x} + 3s$

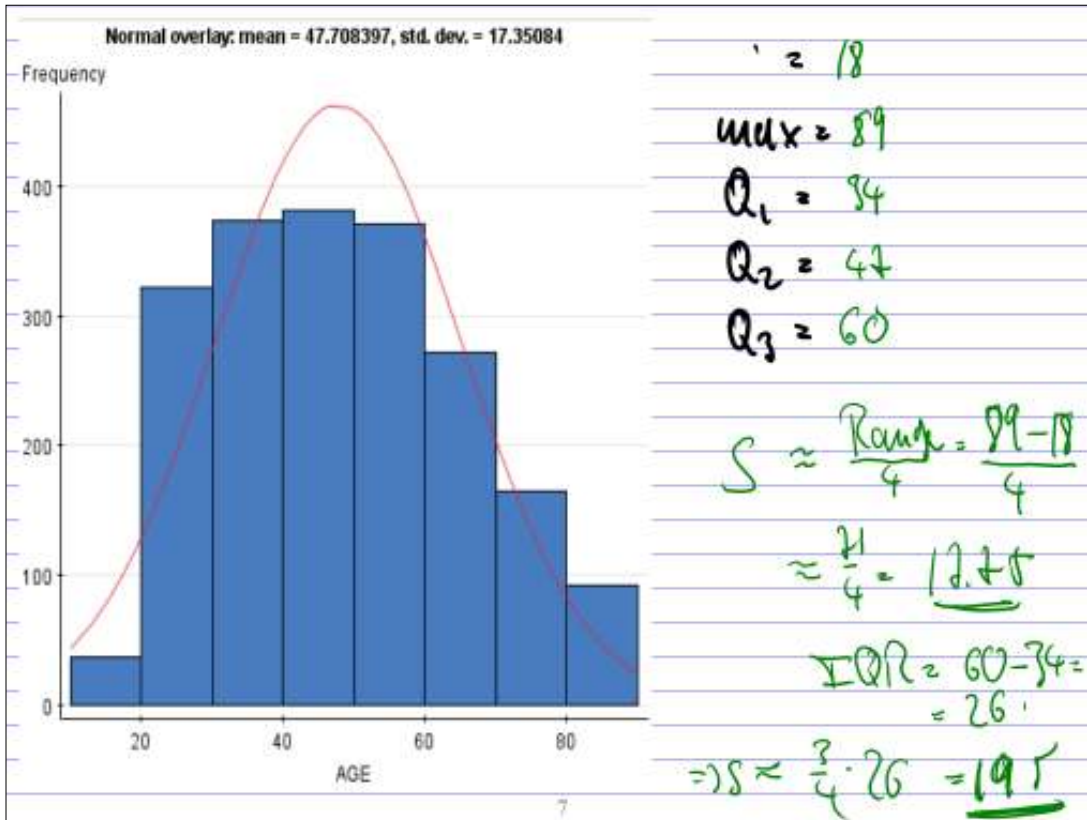
$\approx 4s = \text{range!}$

$$s \approx \frac{\text{Range}}{4}$$



6

Panel 7



Panel 8

**IQR and Standard Deviation**

If distribution is skewed, that impacts mean and standard dev.

To estimate median, use mean and adjust for skewness

To estimate std dev.  $s \approx \frac{3}{4} IQR$  Euler-Quintile-Rump  $Q_3 - Q_1$