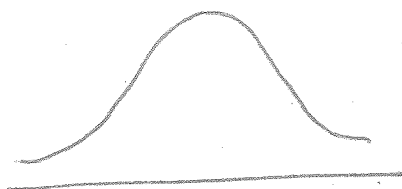
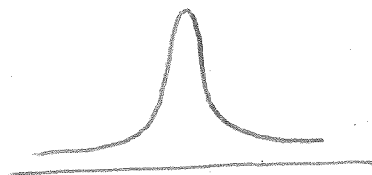


## 6.2 Measures of Spread

Two distributions with the same mean:



larger spread



smaller spread

Range = maximum value - minimum value

Quick Ex: 7, 54, 42, 3, 15

$$\begin{aligned} \text{range} &= 54 - 3 \\ &= 51 \end{aligned}$$

Range is too simple to be very useful.

Population Variance: The average of the squared distances to the mean.

It's written  $\sigma^2$ .

$\sigma$  is the population standard deviation.

Ex: Consider the population 20, 50, 77.  
Calculate  $\sigma^2$  and  $\sigma$ .

$$\mu = \frac{20 + 50 + 77}{3} = 49$$

$x$	$x - \mu$	$(x - \mu)^2$
20	-29	841
50	1	1
77	28	784

$$\sigma^2 = \frac{841 + 1 + 784}{3}$$
$$= 542$$

$$\sigma = \sqrt{542}$$
$$\approx 23$$

WON'T  
BE  
TESTED

FACT

The larger  $\sigma$  is, the more spread out the data is.

Ex: Without calculating, find the standard deviation of  $: 2, 2, 2, 2.$

$$\sigma = 0$$

Ex: Data Set A has  $\sigma = 3$

" B "  $\sigma = 5.$

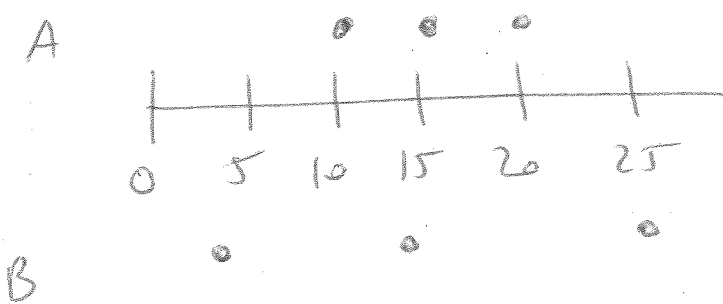
Which is more spread out?

Data Set B.

Ex: Data Set A : 10, 15, 20

Data Set B : 5, 15, 25

Which has the larger standard deviation?



Data Set B

Fact

If all measurements are increased by  $k$ ,  
then  $\sigma$  is unchanged.

If all measurements are multiplied by  $k$ ,  
then  $\sigma$  is multiplied by  $k$ .

Ex: Data Set A: 10, 15, 20

" B: 15, 20, 25

Which has the larger standard deviation?

Notice: Each measurement was increased by 5.  
The standard deviations are the same.

Ex: Data Set A: 10, 15, 20

" B: 20, 30, 40

Which has the larger standard deviation?

Notice: Each measurement was doubled.

Data Set B.

Ex :

What happens to mean, median, range and standard deviation if =

a) Every measurement is increased by 8?

mean increases by 8

median "

range does not change

standard deviation does not change

b) Every measurement is multiplied by 8?

mean, median, range and standard deviation are all multiplied by 8.

Sample standard deviation is written  $s$ .  
It's very similar (but not identical) to  $\sigma$ .