

STATISTICS (Measures of central tendency)

There are at least three measures of location - The mean, the median and the mode. They all give a single figure, which represents the data, and are located around the middle of the set of observations.

We now come to measures of central tendency. These can tell us how close to the centre the observations lie or how spread out they are. These are therefore **measures of spread**.

The simplest measure of spread is the **range** and is the highest minus the lowest observation.

The next one is the **inter-quartile range** and is read off from the Cumulative Frequency graph.

This gives a single figure over which range the middle 50% of the observations cover.

Supposing I observed the following observations: 5, 6, 10, 13, 21.

The **range** would be $21 - 5 = 16$.

The upper quartile is 13 and the lower quartile is 6. The **inter-quartile range** is $13 - 6 = 7$.

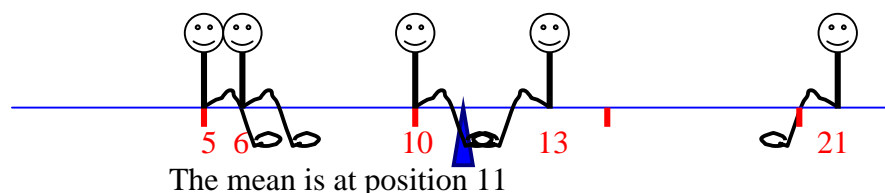
The trouble with the range is that it only takes account of two of the observations - the first and the last.

Let us think about a measure of spread that involves all the observations.

The mean deviation

Deviation is the deviation from the mean. The mean is 11 and so the deviations are the distances between the mean and each of the observations.

This is the mean: $(5 + 6 + 10 + 13 + 21)$ divided by 5 which equals $55 \div 5 = 11$



The **deviations** are $(5-11)$ $(6-11)$ $(10-11)$ $(13-11)$ $(21-11)$
 -6 -5 -1 2 10

The mean of these deviations would be $\frac{-6 - 5 - 1 + 2 + 10}{5}$ which is **zero**

This figure will always come to **zero** - the positive values will cancel out the negative values.

One thing we could do is to ignore signs. This is called the **mean absolute deviation**.

M. A. D. will be $\frac{6 + 5 + 1 + 2 + 10}{5} = \frac{24}{5} = 4.8$

However, the measure of spread which is most commonly used is the **Variance**

This is the **mean of the squared deviations**. Squaring will also get rid of the negative values.

For observations presented in a grouped frequency table: The mean here is 15.5.

Group or class interval	Frequency	Mid point	mid point - mean	(mid point - mean) ² x Frequency
1 - 5	8	3	-12.5	156.25 x 8 = 1250
6 - 10	13	8	-7.5	56.25 x 13 = 731.25
11 - 15	27	13	-2.5	6.25 x 27 = 168.75
16 - 20	31	18	2.5	6.25 x 31 = 193.75
21 - 25	15	23	7.5	56.25 x 15 = 843.75
26 - 30	6	28	12.5	156.25 x 6 = 937.5
TOTALS	100			4125

The **variance** = $\frac{4125}{100} = 41.25$ and the **standard deviation** is $\sqrt{41.25} = \mathbf{6.42}$

check: $15.5 - 2 \times 6.42 = 2.66$ and $15.5 + 2 \times 6.42 = 28.34$

almost all the observations lie between 2.66 and 28.34.