

1.9 Measures of Spread

Measures of central tendency are values around which a set of data tends to cluster. However, to analyse a set of data, it is useful to know how spread out the data are.

Measures of spread describe how the values in a set of data are distributed.

Range is the difference between the greatest and the least values in a set of data.

Quartiles are three values that divide a set of data into four intervals with equal numbers of data.

Interquartile Range (IQ) is the range of the central half of a set of data when the data are arranged from least to greatest (a measure of how closely data clusters around its median)

Box-and-whisker plot is a graph representing the first quartile, the median, and the third quartile of a set of data with a box. The least and greatest data are represented by lines (whiskers) extending from the box.

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Ex 1: The data shows the number of pizzas sold at a local restaurant for the last 12 days.

8 10 14 20 17 10 4 2 24 22 20 21

a) Order the data from least to greatest:

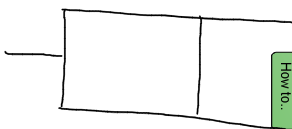
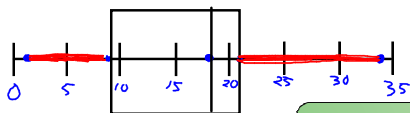
2 4 8 10 14 17 19 20 21 22 26 34
 $Q_1 = 9$ $Q_2 = 18$ $Q_3 = 21.5$

b) Determine the median.

$$\frac{17 + 19}{2} = 18$$

Determine the median of the bottom half of the data. This is Q1, the first quartile.
 Determine the median of the top half of the data. This is Q3, the third quartile.

c) Display the data in a box-and-whisker plot using an appropriate scale:



How to:

- First you will need to draw an **ordinary number line** that extends far enough in both directions to include all the numbers in your data.
- locate the **median** using a vertical line just above your number line
- do the same for Q₁ and Q₃
- Next, draw a box using the lower and upper median lines as endpoints
- Finally, the **whiskers** extend out to the data's smallest number and largest number

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There are two measures of spread:

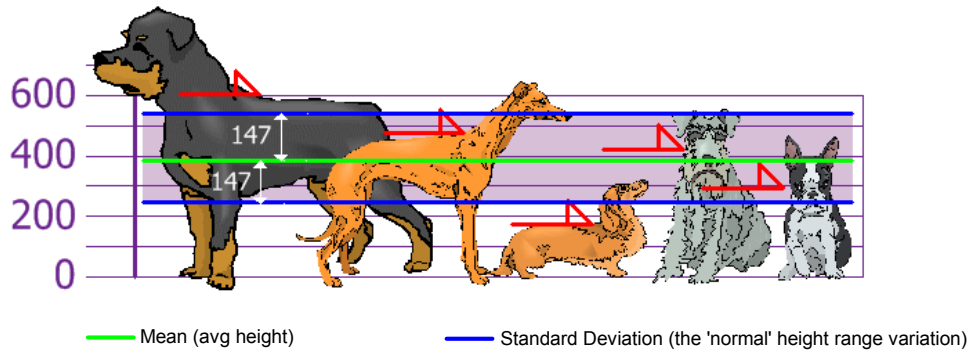
Variance is the mean of the squares of the deviations from the mean for a set of data

$$\text{Variance} = \frac{(x_1 - \text{mean})^2 + (x_2 - \text{mean})^2 + (x_3 - \text{mean})^2 + \dots + (x_n - \text{mean})^2}{n}$$

Standard deviation is:

$$\text{Standard deviation} = \sqrt{\text{Variance}}$$

- the typical distance of a particular value from the mean
- the greater the standard deviation, the greater the spread of the data



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Ex 2: Jordan's weekly food expenses are listed below. Calculate the range, mean, variance and standard deviation.

60 75 72 86 95 55 80 87 65 62

range: $95 - 55 = 40$ mean: $\frac{737}{10} = 73.7$

Use the table below to calculate the variance...

expenses (in dollars)	data - mean	(data-mean) ²
55	$55 - 73.7 = -18.7$	$(-18.7)^2 = 349.7$
60	$= -13.7$	187.7
62	$= -11.7$	136.7
65	$= -8.7$	75.7
72	$= -1.7$	2.89
75	$= 1.3$	1.69
80	$= 6.3$	39.7
86	$= 12.3$	151.29
87	$= 13.3$	176.4
95	$= 21.3$	453.7
		Total 1576

$$\text{Variance} = \frac{\text{total}}{\# \text{ data}}$$

$$\text{Standard Deviation} = \sqrt{\text{variance}}$$

$$= \frac{1576}{10}$$

$$= 157.6$$

$$= \sqrt{157.6}$$

$$= 12.5$$

$$\therefore 73.7 \pm 12.5$$

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Homework

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