

Dispersion

What is Dispersion?

- how data is dispersed.
- how data is spread over the whole range of data.
- mean, median and mode give an indication of central tendency, dispersion gives an indication of spread.
- measures of spread include: range; mean absolute deviation, variance and standard deviation

Range

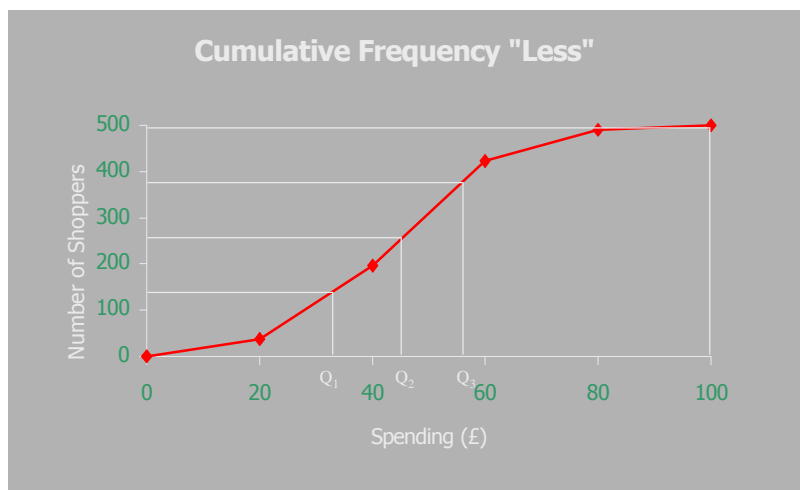
- the range is the difference between the highest data value and the lowest data value.
- with a data range such as: 95, 52, 13, 45, 59, 23, 37, the range is $95 - 13 = 82$
- the range does not tell us how the data is spread, but does tell us the extent of the spread.

Fractiles

- a fractile is a statistic that denotes the boundary of a fractional part of the data
- the most commonly used are:
 - quartiles
 - deciles
 - percentiles

Quartiles

there are three quartiles and they divide the data into four equal parts
the lower quartile is one quarter through the data, the upper quartile is three quarters through the data, the middle quartile is two quarters through the data (is halfway) so is calculated in the same way as the median



Deciles

there are nine deciles and they divide the data into ten equal parts

Percentiles

there are ninety-nine percentiles and they divide the data into one hundred equal parts

Unit 5: Quantitative Techniques for Business

Mean Absolute Deviation

here we measure the average deviation from the mean.

consider a very simple set of numbers

1, 2, 3, 4, 5, the mean is 3

Mean Absolute Deviation

Number	Deviation from the Mean	Absolute Deviation
1	$3 - 1 = 2$	2
2	$3 - 2 = 1$	1
3	$3 - 3 = 0$	0
4	$3 - 4 = -1$	1
5	$3 - 5 = -2$	2
	Total	6

the sum of the absolute deviations is 6

the total absolute deviation from the mean is 6

the average absolute deviation from the mean is $6 \div 5 = 1.2$

the mean absolute deviation (MAD for short) from the mean is 1.2

The Variance

we can overcome the problems of negative deviations by squaring the deviations, because when two negative numbers are multiplied together the result is a positive number.

The Variance

Number	Deviation from the Mean	Squared Deviation
1	$3 - 1 = 2$	4
2	$3 - 2 = 1$	1
3	$3 - 3 = 0$	0
4	$3 - 4 = -1$	1
5	$3 - 5 = -2$	4
	Total	10

the sum of the squared deviations is 10

the total squared deviation from the mean is 10

the average squared deviation from the mean is $10 \div 5 = 2$

the variance from the mean is 2

the only problem now is units, if it was cm, the variance is now cm^2

Standard Deviation

standard deviation is the square root of the variance, as the variance is the sum of the squares of differences, then taking the square root of that sum is logical

standard deviation is the most commonly used measure of dispersion

using the previous example, the standard deviation is $\sqrt{2} = 1.41$ (two decimal places)