Averages Screenshots
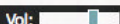
Numeracy: Level 2
Unit: Calculating the Average

Learning Objectives
By the end of this session you will know how to:

- Find the mean, median and mode and use them to compare two sets of data. (HD1/L2.3)
- Apply each average to a relevant situation. (HD1/L2.3)
- Find the range and use it to describe the spread within sets of data. (HD1/L2.4)

Prior knowledge required
You should already know how to:

- review and compare data generated from surveys;
- know how to add and divide;
- order numbers in numerical order;
- round numbers up and down to a defined number of decimal places.

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Mean, Mode and Median

When we talk about 'the average' we are usually talking about the mean. However, there are two further averages you should be aware of the mode and the median. Within this unit you will learn when to use each one..

But first, let's consider how we find an average whichever type we are referring to. In order to find an average you need to collect data; either from a survey or an experiement, or simply by asking questions.

I'm sure you will have been stopped when out shopping and asked if you wouldn't mind sparing a few minutes to take part in a survey. The answers you give are data and when combined with the data collected from other people, you can start to analyse it and work out averages.

Median?

Mean?

Mode?

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Analysing Data

So when we ask a question, we gather answers. These can be considered results or data. We can then analyse this data to provide interesting observations about it, such as the average.

For example:

A manager of a shoe shop might like to know the average shoe size of her customers so that she can get an idea of how much stock she needs to order.

We'll use the shoe shop scenario throughout this unit in order to explain the differences between the three types of averages.
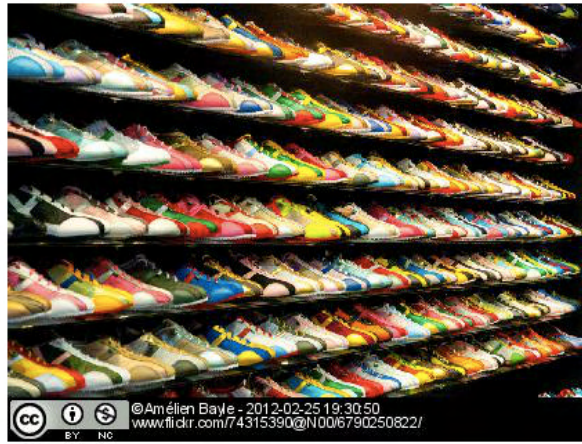
Displaying Data - 1

The manager of the shoe shop has asked her staff to note the shoe size of every pair of women's shoes they sell during one day.

At the end of the day the manager puts all the results into a table.

Size of women's shoes sold in one day

Shoe Size	Number of customers
Size 4	3
Size 5	5
Size 6	7
Size 7	15
Size 8	8
Size 9	5
Size 10	2

Displaying Data - 2

Another way to show this data is to write it a long line, as shown here.

By writing the sizes of shoes in order we have formed what are known as *data sets*. Click on each data set - the 4s, the 5s etc. to learn more about them.

Size 5
Five pairs of size 5 shoe were bought.

4, 4, 4, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6,
7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,
8, 8, 8, 8, 8, 8, 8, 8, 9, 9, 9, 9, 10, 10

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Calculating the Mean

Watch this short video to find out how the **mean** average is calculated.

4, 4, 4, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6,
7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,
8, 8, 8, 8, 8, 8, 8, 8, 9, 9, 9, 9, 10, 10

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Calculating the Mean

In summary the mean can be calculated by:

1. Adding together all the data to give a total;

2. Dividing this total by the number of events that occured.

For our shoes we found that the

Mean Average = 104/44 = 6.9

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The Mean Versus the Mode

Sometimes the mean isn't the most appropriate average to use.

Shoes don't come in a size 6.9 and therefore the mean average is of little use. What we really wanted to know was which shoe size was the most popular.

The **mode** is the average that looks at the data and tells us which one appears the most often.

It's a good idea to think **mode = most**. You could remember that they are both 4-letter words starting with the same two letters; 'mo...'.

Or think about another meaning for the word 'mode'. When something is 'in mode' it is fashionable - it is the popular choice

Let's take a look at our shoe size data again.

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Shoe Shop

By laying out all of our data in a long line we can clearly see that the shoe size that appears the most often is shoe size 7.

4, 4, 4, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6,
7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,
8, 8, 8, 8, 8, 8, 8, 8, 9, 9, 9, 9, 10, 10

The modal shoe size average is therefore 7 as it appears the most number of times (fifteen).

Mode Average = 7

Size 7
15 pairs of size 7 shoes were purchased on this day.

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The Mode

It is also possible to spot the **modal** average quite quickly by looking at our original table.

Here we can see straight away that the most number of shoes sold are a size 7.

Using this type of average makes perfect sense when ordering more shoes.

Let's now see what the median avaerage tells us.

size of women's shoes sold in the shop in one day	
Shoe Size	**Number of customers**
Size 4	3
Size 5	5
Size 6	7
Size 7	15
Size 8	8
Size 9	5
Size 10	2

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The Median

The **median** is the third type of average you.

The median can be thought of as the **middle** value in our data.

A good way to remember this is that 'median' and 'middle' both have 6 letters.

To find the media therefore you simply ignore the value of the numbers to start with and just find the place in the middle.

Here we don't actually have a number in the middle because we started with 44 data entries and that's an even number. When this happens you:

Add the two numbers either side of the 'middle' 7+7=14
Divide by 14/2 = 7.

Median Average = 7.

4, 4, 4, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6,
7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,
8, 8, 8, 8, 8, 8, 8, 8, 9, 9, 9, 9, 10, 10

Median = Middle

Mistakes in the Data

Our median average worked out as 7, the same as the mode average. So you may be thinking why not use the median average instead of the mode. Well let's explore that a bit more.

In Europe, shoe sizes are measured in a different scale with a UK women's size 7 is the same as a European size 40.

Let's suppose that a shop assistant accidently wrote down two European shoe size in amongst the UK shoe sizes when she sold two pairs of shoes.

Let's see if this has any affect on our average calculations.

size of women's shoes sold in the shop in one day

Shoe Size	Number of customers
Size 4	3
Size 5	5
Size 6	7
Size 7	13
Size 8	8
Size 9	5
Size 10	2
Size 40	2

Shoe Shop's new Median

Watch the video to find the new median.

Remember to find the median average you simply find the middle value of your data **once** it has been put in numerical order from smallest to largest.

So the **median average shoe size is 7**. This is despite having 2 pairs of shoes recorded wrongly.

4, 4, 4, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 8, 8, 8, 8, 8, 8, 8, 8, 8, 9, 9, 9, 9, 10, 10, 40, 40

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Note:
Where there are an even number of events, such as in our example, the last two data points are added together and divided by two to find the median.

For example, we were left with a 7 and a 7 when we removed all the other data points.

Therefore the median can be worked out by working out 7 + 7 = 14 divided by 2 = 7.

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New Mean and Mode

Total of all shoe sizes = 370
Number of shoes sold = 44

Mean average = 370/44 = 8.409

Just by mis-recording two of the 44 pairs of shoes sold that day we have increased the mean average by 1.5 shoe sizes.

Mode Average = 7 Shoe size 7 is still the most popular. Because the size 7 shoe size was be far the most popular, the shop assistants mistake didn't affect the results on this occassion.

Size 7
13 pairs of shoes are recorded as being sold in a size 7.

4, 4, 4, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6,
7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 8, 8,
8, 8, 8, 8, 8, 8, 9, 9, 9, 9, 10, 10, 40, 40

Results

Here the Shop Manager was likely to use the Mode and so she would still have ordered more shoes of the most popular size.

But

If sales in the different shoe sizes had been more even then accidently recording some data entries could have easily changed the results, not just for the mean but for the mode too.

Although the median still indicated the correct shoe size, that would not have been the case if lots of mistakes had been made.

Data must be in the same units to have reliable results.

Before the mistake
4, 4, 4, 5, 5, 5, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6, 6, 6, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 8, 8, 8, 8, 8, 8, 8, 9, 9, 9, 10, 10

Mean = 6.6   Mode = 7   Median = 7

After the mistake
4, 4, 4, 5, 5, 5, 5, 5, 5, 5, 5, 6, 6, 6, 6, 6, 6, 6, 6, 7, 7, 7, 7, 7, 7, 7, 7, 8, 8, 8, 8, 8, 8, 8, 9, 9, 9, 10, 10, 40, 40

Mean = 8.1   Mode = 6   Median = 7

The Range

Another thing we are often asked when analysing data is to provide the **range**.

The range tells us the spread of the data.

Look at this bingo card.

Can you find the...

...lowest number?
...highest number?

http://www.freedigitalphotos.net/images/view_photog.php?photogid=1674

Image by Anankkml

The Range

The range is calculated by finding the difference between the highest number and the lowest number.

Range = Highest number - Lowest number

So here the

Range = 70 – 5 = 65

http://www.freedigitalphotos.net/images/view_photog.php?photogid=1674

Image by Anankkml

Questions

What is the **mean** monthly cost of Michael's mobile phone bill?

January: £20
February: £24
March: £18
April: £23
May: £29
June: £25
July: £24
August: £31
September: £18
October: £24
November: £27
December: £25

Answer

The mean average phone bill was £24.

How did we calculate it?

Add together all the mobile phone bills for each month:
= 20 + 24 + 18 + 23 + 29 + 25 + 24 + 31 + 18 + 24 + 27 + 25
= 288

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Questions

What was the **range** of monthly mobile phone bills?

January: £20
February: £24
March: £18
April: £23
May: £29
June: £25
July: £24
August: £31
September: £18
October: £24
November: £27
December: £25

Answer

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Which average would you use to find the best representative average of UK house prices?

- Mean
- Mode
- Median
- Range

Check

Questions

House prices vary quite a bit throughout the UK. Houses in the north tend to be cheaper than houses in the south and then there are properties in London selling for millions of pounds.

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Questions

Pass rates at The Learning Place in Portsmouth on the maths courses are good. What is the **median** mark from this class?

55%
87%
65%
63%
100%
60%
57%
92%

Answer

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Questions

Samantha wants to buy a new car and does some research on the Internet. She finds 8 cars all of a similar mileage, age and condition.

To the nearest pound, what is the **mean** average for this make and model of car?
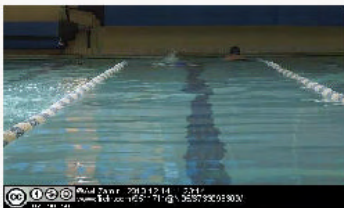

£1995
£2250
£1650
£1999
£1895
£2495
£2245

[Answer]

Questions

Charlie decides to do a sponsored swim for Sports Relief this year. He gets various friends and family to sponsor him and their pledges are recorded on his sponsor form. What is the **modal** average (the mode) amount of money Charlie is sponsored for?

Mum: £20
Dad: £20
Kim: £5
Granddad: £10
Nanny: £10
Uncle Paul: £15
George: £2
Laura: £10

[Answer]

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Averages and range

Tips for tutors [T]

First time here? Watch this one-minute video, then choose a level.

Start
Choose a leve

▶ One-minute video

?
To find an average of a set of figures, add them all up

Entry 1
Coming so

Entry 3
The basic

Level 1
Essential

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Measures of average - Introduction

A measure of average is a number that is typical for a set of figures. Finding the average helps you to draw conclusions from data. The main types are mean, median and mode.

This Revision Bite covers:

- The mean
- The median
- The mode
- The range

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Summary

Within this unit we have looked at the three types of average calculation - mean, mode and median. You will now know how to calculate them and when each should be used.

We have also learnt what the range is and how to calculate it.

You have now completed the unit.