

Are you sure?

I once heard it said “An artist, a scientist and a mathematician took a trip to Wales. They were out walking together when they came across a rabbit.

“Oh,” said the artist “in Wales the rabbits are brown.”

“Oh no,” said the scientist “we can only say that at least one rabbit in Wales is brown.”

“No” said the mathematician “we can only say with any certainty that at least one side of one rabbit in Wales is Brown.”



So, who is right?

I have been to Wales many times and seen a lot of brown rabbits. Is that enough evidence to say that all the rabbits in Wales are brown?

A **population** is the complete set of members in a particular group. In our example, above, that would be all the rabbits in Wales.

A **sample** is a small group taken from the population. In our example above that would be all the rabbits we saw in Wales.

When studying a population, it is not always possible to study the whole population – it may be too big (is it possible to look at every rabbit in Wales?), or you may not be able to get all the data you require. In such cases, we would just study a part of the population. If this sample is chosen carefully, we can draw conclusions about the whole population. If the sample is not chosen carefully, or is too small, then we might draw conclusions that are not right.

For each of these scenarios, decide if the sample is a good sample or not, and give your reasons:

Sample	Good or bad sample Reason
Example: My friend and I go to Wales to find out about the wild rabbits. We see 5 brown rabbits in a field, so decide the wild rabbits in Wales are all brown.	Bad sample We have only sampled 5 rabbits and they are all in the same field. We should have noted the rabbits in several different areas of Wales.
A dinner lady wants to know which pizza toppings are most popular in her school. She makes a questionnaire and gives it to every 10 th child in the dinner queue to fill in.	
Maddy wants to know about favourite sports among teenagers. She makes a questionnaire and asks 12 of her friends to fill it in.	
Josh runs an ice-cream shop. He's come up with a new recipe for strawberry ice-cream. He prepares 100 samples of each strawberry ice-cream recipe and labels them A & B. When customers come into his shop one Tuesday afternoon he offers them the free samples and asks which they prefer. He repeats this until all the samples have been consumed.	
The RSPB want to keep a record of bird populations across the UK. Each year the RSPB asks its members to record the number of each bird species they see in their garden during any one 1 hour of a given week. Respondents are asked to record the date, time and maximum number of each species seen during their hour. Approximately 85% of members complete the survey.	
In the run up to a general election a journalist tries to find out the popularity of the different parties. He asks people of voting age to ring into a local radio show in three different counties, to say who they will vote for.	
As part of a psychological study, Misha is studying the effect of a new memory trick. She arranges with one of the teachers at her old school to test the trick with the students in his year 9 and year 11 classes (54 students in total). Misha supplies two lists, each with 20 different objects to the teacher. First the teacher gives the students the list to learn by displaying it on his screen. After 3 minutes he hides the list and students have to write down all the objects they can remember. He then teaches them the memory trick and gives the students 3 minutes to learn the other list in the same way. Again, the students are asked to write down all the objects they can remember. The teacher gives the lists to Misha at the end of the day.	

Summary statistics are a good way to describe a population.

In a test at Womble School, the **mean** mark was **51**, the **median** mark was **53** and the **range** was **72**.

The results for the same test in Hobbit School showed a **mean** of **54**, the **median** mark was **49** and the **range** was **48**.

What do these statistics tell us about the results in the two schools?

Use three colours – One to say definitely true
One to say definitely not true
One to say maybe, there is not enough information

No one in Hobbit School scored 100

More students passed the test in Womble School

The highest mark in Womble School was 85 and the lowest was 13

The students study harder in Hobbit School than Womble School

The highest mark in Womble School was 90 and the lowest was 18

No one in Womble School scored 100

The teachers are better in Hobbit School than in Womble School

The Highest mark in Womble School was 100 and the lowest was 28

Here is some more information about the two schools:

The highest mark in both schools was 90

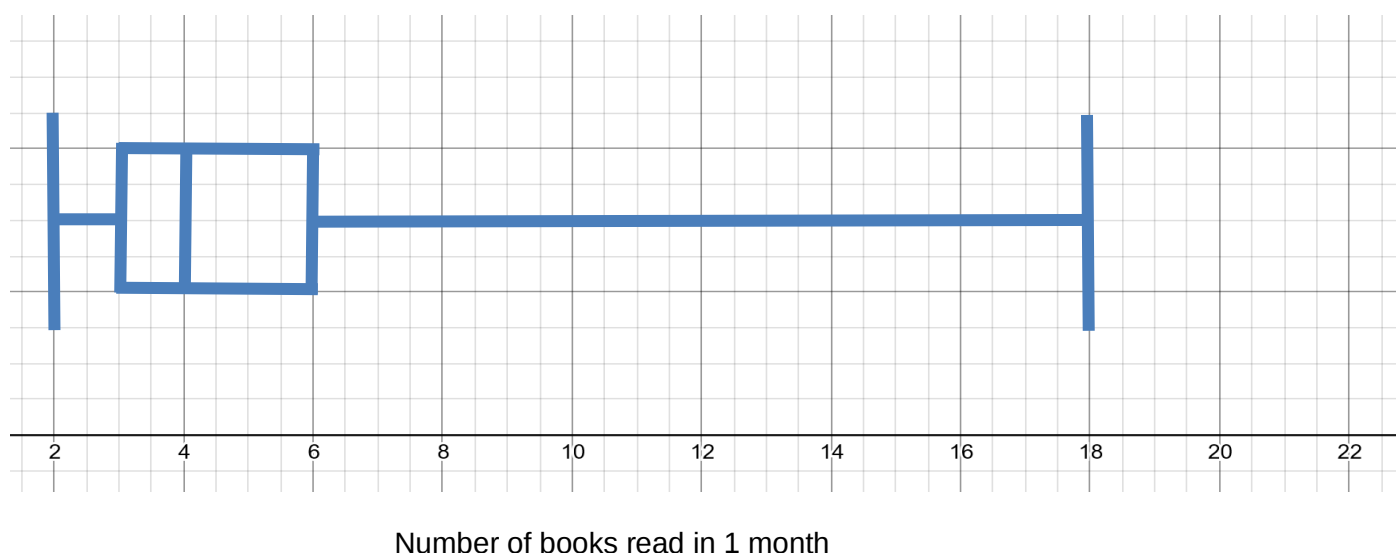
The pass mark was 52

Put a tick next to any of the statements above which you coloured as “unsure” that you can now say is true.

Manmeet wanted to study the reading habits of the people who lived in her town. After surveying 200 people she found:

- All of them visit the town library at least once per month
- 112 people said they liked reading fiction best
- 62 said they only came to the library to use the computers or find information from other reference material
- 180 said they are more likely to borrow a book from the library than to buy a book

She also asked about the number of books people read in the last month and put her results into a box plot as follows:



Answer these questions for Manmeet's sample:

What was the lowest number of books read in the last month?

What was the highest number of books read in the last month?

What was the median number of books read in the last month?

What is the range in the number of books read in the last month?

What is the interquartile range in the number of books read in the last month?

Manmeet did her survey at her local library. Do you think the results of her sample are a good representation for the population of her town?

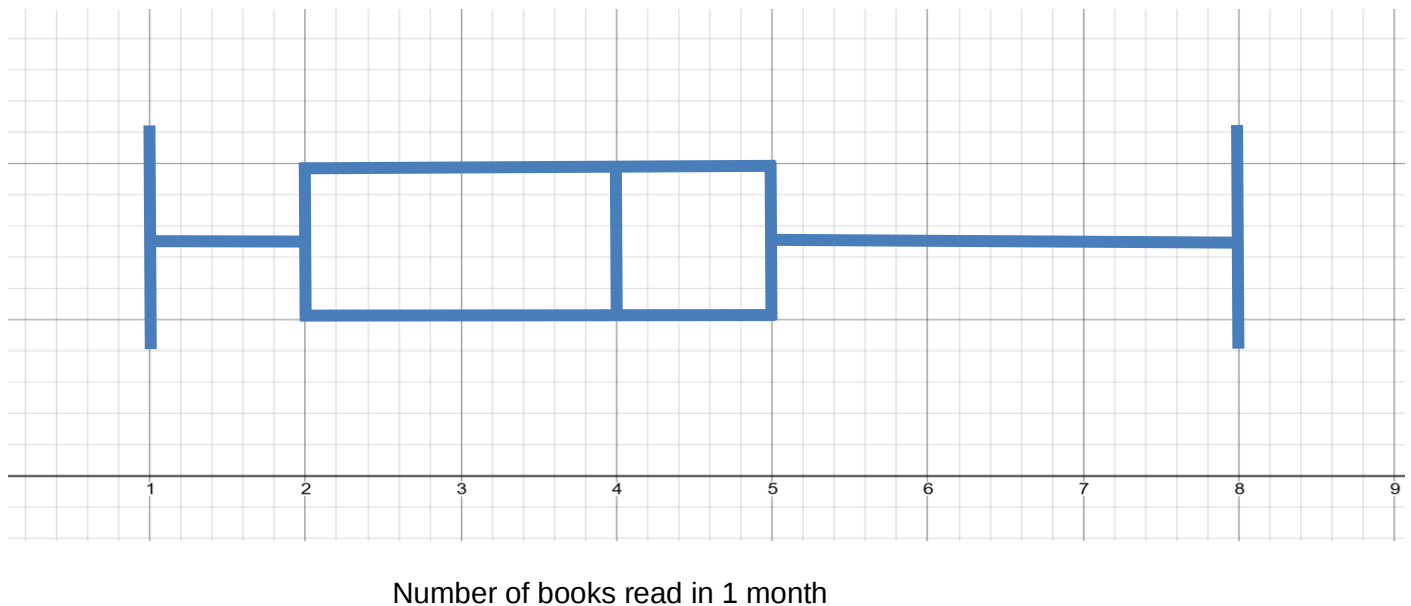
What should she have done to get a better representation?

What was her real population?

Samuel also wanted to study the reading habits of people in his town. He surveyed 80 people and found out:

- 44 of them visit the town library at least once per month
- 65 people said they liked reading fiction best
- 12 said they only came to the library to use the computers or find information from other reference material
- 54 said they are more likely to borrow a book from the library than to buy a book

He also asked about the number of books people read in the last month and put his results into a box plot as follows:



Answer these questions for Samuel's sample:

What was the lowest number of books read in the last month?

What was the highest number of books read in the last month?

What was the median number of books read in the last month?

What is the range in the number of books read in the last month?

What is the interquartile range in the number of books read in the last month?

Samuel did his survey at school, he asked 10 students in each year 7 – 13 and 10 teachers. Do you think the results of his sample are a good representation for the population of his town?

What should he have done to get a better representation?

What was his real population?

White Rhinos are a near threatened species native to Africa. Even though they are called white rhinoceros they are actually grey! Although they are near threatened their numbers are currently on the increase, thanks to reserves and the protection of many organisations.

Fun fact: The collective for rhinos is a crash or a herd.

Fun fact: The main difference between white rhino and black rhino is the shape of their lips – white rhino have a square/rectangular  shape lip whilst black rhinos have a triangular  shape lip



Semi and his team studied fifteen white rhino herds in their natural habitats over many years in different locations across Africa. They found:

- The average number of rhinos in a herd was 8.3
- Herds consisted of more females than males
- After giving birth, the calf remained with the herd for two to three years
- Females give birth to a single calf every 3 – 5 years
- The males showed a wider variety of sounds and were more vocal than the females
- All fifteen herds lived in protected areas
- The longer horn of an adult rhino was between 1.5 and 4 feet long, with the median for females about 3½ feet and for males about 2 feet.
- All the rhinos seemed to enjoy rolling in mud to cool down, which they engaged in whenever they had the chance.
- Sometimes herds travelled for up to 4 days without drinking any water
- White rhinos showed a preference for short grass
- The number of rhino deaths from poachers increased exponentially between 2007 and 2014. Since 2014 the number has steadily decreased a little, but is still greater than in 2012
- The number of armed guards at reserves has increased



How well do you think these sample findings represent the rhino population in the wild?