
Mean and Standard Deviation

1. Adam and Barry play for the Ketterby cricket team.

Here are their scores in their last 10 innings:

Adam	13	126	64	37	63	27	0	102	12	56
Barry	61	54	40	47	62	32	39	69	43	53

Which would you pick for an important game?

2. Super Crisps come in 25g bags. There are two machines producing the crisps. A quality control engineer weighs a sample of 10 bags from each machine.

Machine A	25.3	25.6	24.8	25.7	25.5	25	24.9	25.7	25.5	25.6
Machine B	25.3	25.3	25.4	24.9	25.3	25.3	25.4	25.4	25.4	25.3

Work out the mean and standard deviation for each machine.

Super Crisps will be taken to court if it is found their bags are less than 25g. Which machine gives the best chance of avoiding this fate?

3. ZupaPharm have developed a drug that is supposed to cause weight gain. It is tested on a sample of 50 rats. The results gave a mean weight gain of 12g with a standard deviation of 30g.

Work out a 95% confidence interval for the mean weight gain. Can you be "95% sure" that the drug actually causes weight gain in rats?

4. Samples of fish are taken and weighed from two lakes.

Lake P: 10 fish, mean 156g, s.d. 38g

Lake Q: 20 fish, mean 240g, s.d. 121g

Work out 90% confidence intervals for each lake. Is there evidence (at the 90% level) of a real difference in the weights of fish in the two lakes?

Mean and Standard Deviation

- The **mean** is the average value. Add them up then divide by how many there are.
- The **standard deviation** is a measure of how spread out (or varied) the data is.
- A large standard deviation suggests there is a lot of variation.

- Common symbols for the mean are μ (mu), \bar{x} (x-bar) and m .
- Common symbols for the standard deviation are σ (sigma) and s .

For other than very simple examples the only sensible way to calculate the standard deviation is to use the statistics functions on a calculator, or use a computer.

On a calculator:

- Enter statistics mode on the calculator.
- Clear the statistics memory (typically [Scl])
- Enter the data. Type each number followed by [DATA] or [DT].
- Check you have entered the right amount of data. [n]
- To find the mean press [\bar{x}] or [μ].
- To find the standard deviation press [σ], [σ_n] or [$x\sigma_n$] (or possibly [s], [σ_{n-1}] or [$x\sigma_{n-1}$])
- You may need to return to 'normal' or 'comp' mode if you you want to use non-statistical functions of your calculator.

Standard error

The **standard error** is estimated by $\frac{\sigma}{\sqrt{n}}$, where σ is the standard deviation of a single sample of size n .

Confidence intervals

A 90% confidence interval is (mean) $\pm 1.65 \times$ (standard error)

A 95% confidence interval is (mean) $\pm 1.96 \times$ (standard error).

A 98% confidence interval is (mean) $\pm 2.326 \times$ (standard error).

A 99% confidence interval is (mean) $\pm 2.575 \times$ (standard error).

Normal Distribution

Confidence intervals are normally valid if the data is in a normal distribution, i.e. with a peak at the mean and tailing off to the sides.

