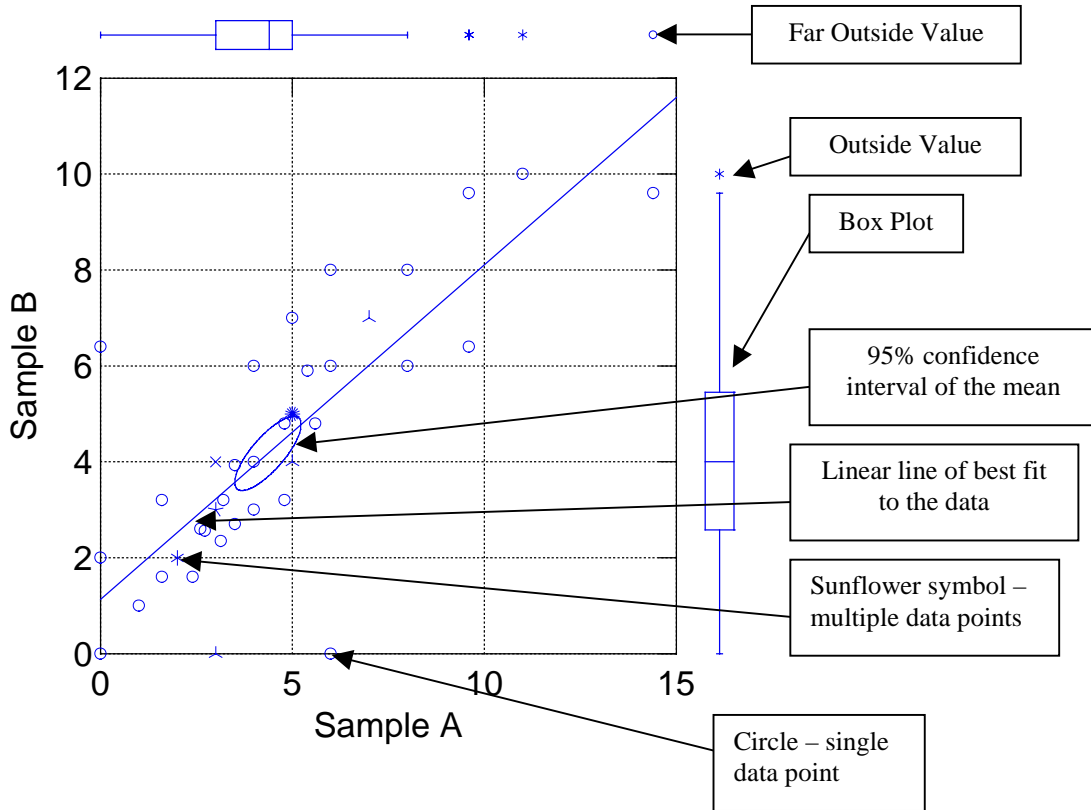


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Free SO₂



Youden Plot

The Youden Plot (as seen above) is a graphical technique which allows for analysing inter laboratory data, where 2 samples have been analysed. The Youden plot allows various questions to be answered, such as:

- 1) Are all the laboratories equivalent?
- 2) Are the errors observed systematic or random?
- 3) What laboratories have outlying values?

If errors are due to random factors, then the results obtained will be scattered randomly about the mean values. This indicates that laboratories influenced by random errors have reproducibility problems with their analysis.

If the errors are due to systematic factors, then the results obtained will be close to the trend line but will be situated in the upper right hand corner of the graph and in the lower left hand corner of the graph. This indicates that laboratories influenced by systematic errors have accuracy problems with their analysis.

Outliers

No algorithm is run to test for outliers, as it is felt that the HADI outlier algorithm built into SYSTAT identifies data points which do not appear to be outliers. Instead points which are obviously outliers, in that they do not fit with the majority of the data, are removed prior to undertaking the statistical analysis.



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95% confidence ellipse for the mean

The ellipse is centered on the sample means of the x and y variables (ie sample A and sample B respectively). The size of the ellipse is strongly influenced by the number of cases (number of laboratories returning results); the larger the number of cases the tighter the ellipse, even though the spread of data may be large.

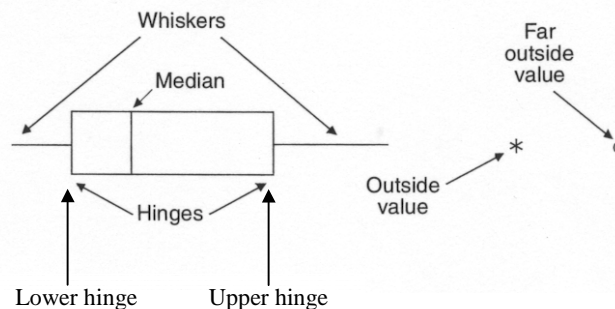
“Sunflower” symbol

Indicates points with the same results – the number of “petals” minus 1, is an indication of the number of cases on one point, up to a maximum of 9.

Linear Line of Best Fit

This line represents the general trend of the data. If the samples contain similar levels of an analyte, and the laboratory’s results reflect this, then this line will go from the bottom left hand corner to the top right hand corner. If the samples are not similar or if results are inaccurate, then the slope of the line will be less and the trend line will tend towards being horizontal.

Box Plot



A box plot allows a visual summary of a distribution of data. The length of the central box shows the range within which the central 50% of the values fall. This is also known as the interquartile range (IQR). The box edges, called the hinges, are defined as the 25th percentile and the 75th percentile, this being the lower and upper hinges respectively.

The median of the data is shown as a line across the box, somewhere between the lower and upper hinges. The whiskers show the range of values which fall within the inner fences (but do not necessarily extend to the inner fences). The inner fences are not pictured on the box plot, but are calculated as:

$$\text{Lower inner fence} = \text{lower hinge} - (1.5 \times \text{IQR})$$

$$\text{Upper inner fence} = \text{upper hinge} + (1.5 \times \text{IQR})$$

There are also outer fences (these are not pictured on the box plots), but are calculated as:



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Lower outer fence = lower hinge – (3*IQR)

Upper inner fence = upper hinge + (3*IQR)

Values between the inner and outer fences are plotted with an asterix, and are questionable.
Values outside the outer fences are plotted with empty circles and are unsatisfactory.

Descriptive Statistics

	FREEA	FREEB
N of cases	60	60
Minimum	0.000	0.000
Maximum	14.400	10.000
Range	14.400	10.000
Median	4.400	4.000
Mean	4.391	4.241
95% CI Upper	5.065	4.855
95% CI Lower	3.717	3.626
Standard Dev	2.610	2.378
C.V.	0.595	0.561

Number of cases = number of laboratories whose results are statistically compared (excludes those removed as outliers).

Minimum case value

Maximum case value

Range – maximum minus minimum

Median – if the cases are ranked, the median is the “middle” value ie. half are above and half below. If the distribution is heavily skewed, the median is less affected by isolated extreme results than the mean.

Mean – the arithmetic average: more useful than the median for further statistical calculations and less susceptible to fluctuation with repeated sampling. If the distribution is “normal” the mean is the same as the median

95% CI Upper, Lower – confidence interval for A and B treated as individual samples, ie. if results fall within this range from mean, 95% probability that they are the same as mean.

C.V. – coefficient of variation (Standard Deviation divided by mean) : gives an indication of relative magnitude of variation in relation to mean.

Standard Deviation – results which are more than 2-3 standard deviations from the mean need close investigation.

Lab result – for your convenience; a space to fill in your own results.



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Z-Scores

The mean and standard deviation of the group of data is used to calculate the Z-score. On their own, the raw data points do not give information about their exact location in regards to other points in the distribution. Z-scores make the raw data more meaningful. For each analyte, two Z-score charts are created; one for sample A and one for sample B. An example is shown below.

Z-scores:

- Tell us the exact location of the original value within the distribution of data.
- Is a signed number (+ or -), which tells whether the score is located above (+) or below (-) the mean (centre line).
- The number tells the distance between the score and the mean in terms of the number of standard deviations.
- The mean is represented by the zero line.

Interpretation of the z-score

- $|z| \leq 2$: Satisfactory
- $2 < |z| < 3$: Questionable
- $|z| \geq 3$: Unsatisfactory

To maintain anonymity, a Z-score number separate to your IWAG lab number will be issued to allow interpretation of the Z-score charts.

X-BAR Chart for FREEA

