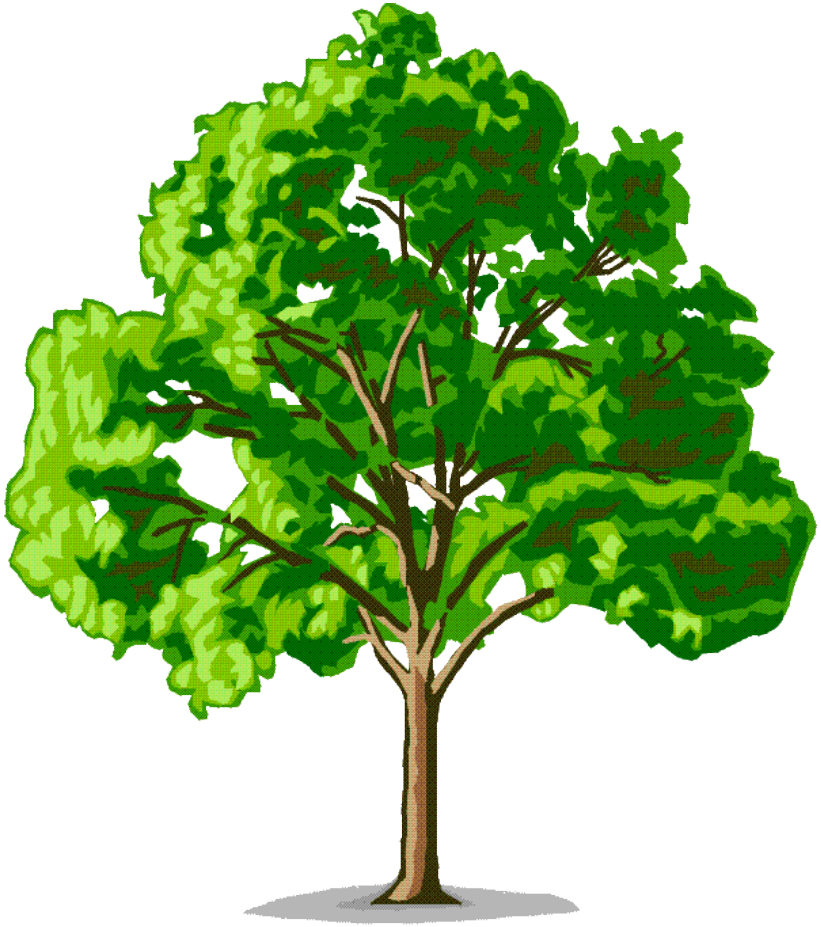
Standard Error & 95% Confidence

Testing the difference between two sets of interval (measured) data

Is there a difference between leaf length at the top of a tree compared with those at the bottom?



Making a Prediction

- With any scientific test you should make a prediction.
- Statistical tests use Null Hypothesis and Alternative Hypothesis.

- Null Hypothesis – there is no significant difference between the two sets of data.

- Alternative Hypothesis – there is a significant difference.

Look at the data

Leaf length at the top of the tree /cm	Leaf length at the bottom of the tree /cm
12	19
15	16
11	24
17	20
15	21
9	18
14	15
13	25
10	27
19	24

Is the difference real (significant)?

Calculate the mean & standard deviation

	Leaf length at the top of the tree /cm	Leaf length at the bottom of the tree /cm
	12 15 11 17 15 9 14 13 10 19	19 16 24 20 21 18 15 25 27 24
Mean	**13.5**	**20.9**
Standard Deviation	**3.1**	**4.0**

Calculate the standard error (=sd/√n)

	Leaf length at the top of the tree /cm	Leaf length at the bottom of the tree /cm
	12 15 11 17 15 9 14 13 10 19	19 16 24 20 21 18 15 25 27 24
Mean	13.5	20.9
Standard Deviation	3.1	4.0
Standard Error	**1.0**	**1.3**

Calculate the 95% Confidence Limits

The 95% confidence limits fall at 1.96 Standard Errors above and below the mean (often rounded to 2xSE).

	Leaf length at the top of the tree /cm	Leaf length at the bottom of the tree /cm
Mean	13.5	20.9
Standard Deviation	3.1	4.0
Standard Error	1.0	1.3
Mean - 2xSE	**11.5**	**18.3**
Mean + 2xSE	**15.5**	**23.5**

So, are the data significantly different?

- If the 95% confidence limits DO NOT overlap, we can say with 95% confidence that the data are significantly different.
  - Or we say there is a less than 5% probability that the difference is due to chance alone.