General Certificate of Education
Advanced Level Examination
June 2014

Biology BIO6T/Q14/task

Unit 6T A2 Investigative Skills Assignment
Task Sheet

Investigating populations

Introduction

You will use leaves of the same plant species to investigate whether there is a relationship between the dimensions of a leaf and the direction the leaf faces.

Materials

You are provided with the following:

- access to a compass (or your teacher will tell you which side of the plant is north-facing and which side is south-facing)
- access to 20 leaves of various sizes, from the same plant species
- flat surface
- ruler.

You may ask your teacher for any other apparatus you require.

Method

Read these instructions carefully before you start your investigation.

Measuring leaves from the north-facing side of the plant

1. Choose a complete leaf from the north-facing side of the plant.

2. Use the ruler to press the leaf against your flat surface.

3. Measure the length of the leaf, in millimetres, but do not include the leaf stalk. Record your results in **Table 1**.

4. Measure the width of the leaf in millimetres. Record your results in **Table 1**.

5. Repeat steps 1 to 4 with nine more north-facing leaves.

Measuring leaves from the south-facing side of the plant

6. Choose a complete leaf from the south-facing side of the plant.

7. Repeat steps 2 to 4.

8. Repeat steps 6 and 7 with nine more south-facing leaves.

You will have recorded the results for 20 leaves in **Table 1**. You may assume that this will give you sufficient data for a statistical test.

You will need to decide for yourself:

- where to measure a leaf to obtain its greatest length
- where to measure a leaf to obtain its greatest width.

ISA BIO6T/Q14 Candidate Results Sheet: Stage 1

Investigating populations

Centre Number | | | | | | Candidate Number | | | | |

Candidate Name.....

1 Complete **Table 1** by calculating length divided by width for each leaf.

[1 mark]

Table 1 Dimensions of leaves

Direction leaf faced	Leaf number	Length / mm	Width / mm	Length divided by width
North	**1**			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
South	**1**			
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			

You will use your calculations of length divided by width in your statistical analysis.

Hand in this sheet at the end of each practical session.

1

End of Stage 1

Turn over ▶

ISA BIO6T/Q14 Candidate Results Sheet: Stage 2

Investigating populations

Centre Number | | | | | | Candidate Number | | | | |

Candidate Name .....

Use a statistical test to analyse your data. You may use a calculator and the AQA Students' Statistics Sheet that has been provided.

A sheet of graph paper is supplied. You may use this if you wish.

2 State your null hypothesis.

[1 mark]

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3 (a) Give your choice of statistical test.

[1 mark]

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3 (b) Give the reason for your choice of statistical test.

[1 mark]

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4 Carry out the test and calculate the test statistic. Show your working.

[1 mark]

5 Interpret the test statistic in relation to your null hypothesis being tested. Use the words **probability** and **chance** in your answer.

[2 marks]

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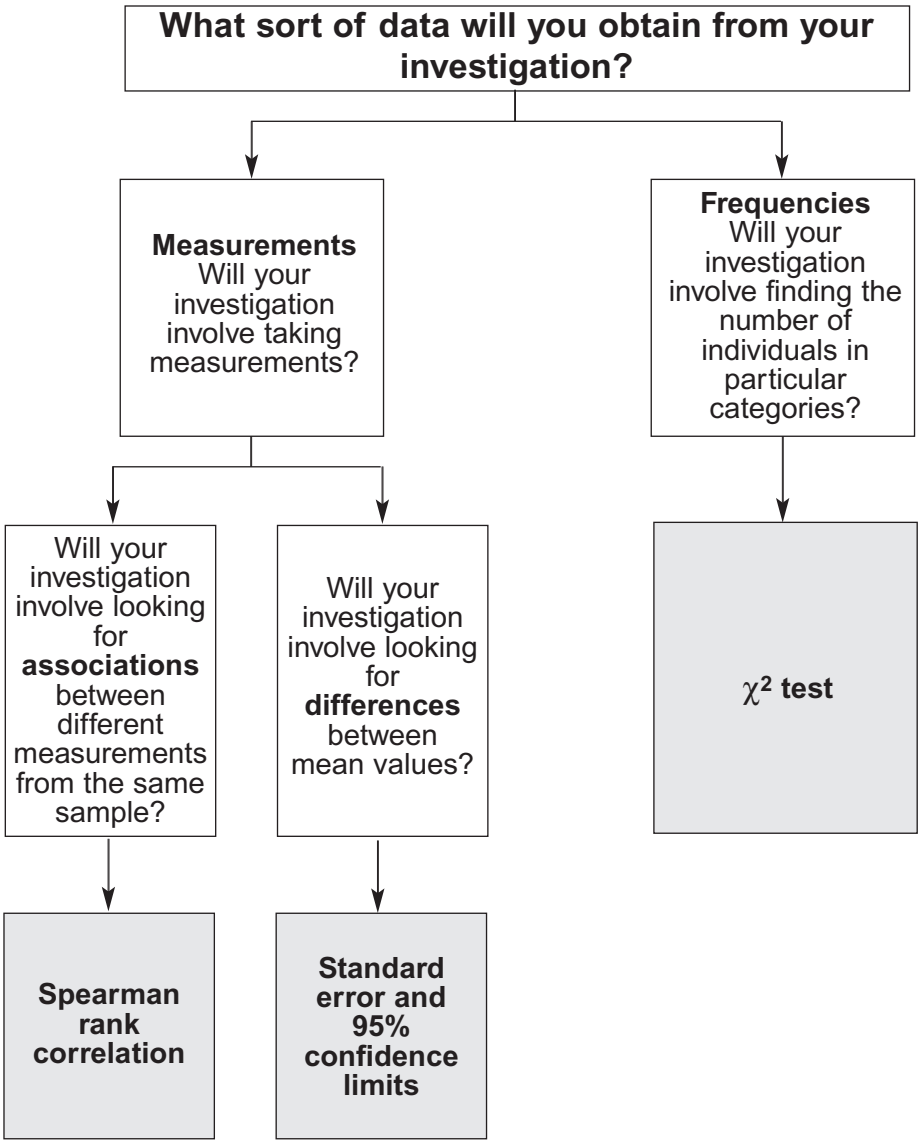
6

END OF QUESTIONS

AQA Students' Statistics Sheet (version 3)



Standard error and 95% confidence limits

Calculate the standard error of the mean, SE, for each sample from the following formula

$$SE = \frac{SD}{\sqrt{n}}$$

where SD = the standard deviation
and n = sample size

95% confidence limits = $2 \times SE$ above and below the mean

For use in the ISA and EMPA assessment

The χ^2 test

The chi-square (χ^2) test is based on calculating the value of χ^2 from the equation

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

where O represents the results you observe in the investigation
and E represents the results you expect.

Table showing the critical values of χ^2 at P = 0.05 for different degrees of freedom

Degrees of freedom	Critical value
1	3.84
2	5.99
3	7.82
4	9.49
5	11.07
6	12.59
7	14.07
8	15.51
9	16.92
10	18.31

Spearman rank correlation test

Calculate the value of the Spearman rank correlation, r_s, from the equation

$$r_s = 1 - \left[\frac{6 \times \Sigma D^2}{n^3 - n}\right]$$

where n is the number of pairs of items in the sample and D is the difference between each pair of ranked measurements.

Table showing the critical values of r_s at P = 0.05 for different numbers of paired values

Number of pairs of measurements	Critical value
5	1.00
6	0.89
7	0.79
8	0.74
9	0.68
10	0.65
12	0.59
14	0.54
16	0.51
18	0.48

For use in the ISA and EMPA assessment