

Paper Reference(s)

**6688**

**Edexcel GCE**

**Statistics S6**

**Advanced/Advanced Subsidiary**

**Wednesday 26 June 2002 – Morning**

**Time: 1 hour 30 minutes**

**Materials required for examination**

Answer Book (AB16)

Graph Paper (ASG2)

Mathematical Formulae (Lilac)

**Items included with question papers**

Nil

**Candidates may use any calculator EXCEPT those with the facility for symbolic algebra, differentiation and/or integration. Thus candidates may NOT use calculators such as the Texas Instruments TI 89, TI 92, Casio CFX 9970G, Hewlett Packard HP 48G.**

**Instructions to Candidates**

In the boxes on the answer book, write the name of the examining body (Edexcel), your centre number, candidate number, the unit title (Statistics S6), the paper reference (6688), your surname, other name and signature.

Values from the statistical tables should be quoted in full. When a calculator is used, the answer should be given to an appropriate degree of accuracy.

**Information for Candidates**

A booklet 'Mathematical Formulae and Statistical Tables' is provided.

Full marks may be obtained for answers to ALL questions.

This paper has seven questions. Pages 6, 7 and 8 are blank.

**Advice to Candidates**

You must ensure that your answers to parts of questions are clearly labelled.

You must show sufficient working to make your methods clear to the Examiner. Answers without working may gain no credit.

1. (a) Explain the difference between parametric and non-parametric methods. (2)
- (b) State when you should use the Wilcoxon rank sum test and when you should use the Wilcoxon signed-ranks test. (2)
- 

2. An experiment was carried out to investigate memory in 2 situations; aural and visual. A random sample of 8 students was shown 20 objects and then each student was asked to recall as many as possible. Subsequently a list of 20 different objects was read out to them and again each student was asked to recall as many as possible. The results are given below.

Student	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>
Visual	14	15	10	9	8	13	17	12
Aural	12	13	9	10	7	14	16	10

Use a sign test to determine, at the 5% significance level, whether or not there is evidence that students can recall objects with greater accuracy when they are presented visually rather than aurally. State your hypotheses clearly. (8)

---

3. The median number of rescues per month for the mountain rescue teams in the Lake District is claimed to be 72. From past records a random sample of 10 months was taken and the numbers of rescues per month were recorded. The results are given below.

60 63 75 70 64 50 67 78 65 73

Use a Wilcoxon signed-ranks test to determine, at the 5% significance level, whether or not the median number of rescues is 72. State your hypotheses and conclusions clearly. (8)

---

4. It is known that in a chemical reaction the amount of compound produced,  $w$  grams, and the temperature,  $t$  °C. are related by the equation

$$w = \alpha + \beta t.$$

The amounts of compound produced for 10 different temperatures were recorded and the following statistics were calculated.

$$S_{ww} = 42.3, \quad S_{tt} = 6.8, \quad S_{tw} = 12.5, \quad \bar{w} = 6.2, \quad \bar{t} = 3.11.$$

- (a) Calculate an estimate for  $\alpha$  and an estimate for  $\beta$ . (3)
- (b) Test, at the 5% significance level, whether or not there is evidence that the regression coefficient is 1.5. (8)
- 

5. In a canning factory, potatoes with blemishes are classified as sub-standard and are removed from the production line. In order to monitor the process, random samples of size 250 are taken at regular intervals. The number of sub-standard potatoes in each sample is counted. The following table shows the number of sub-standard potatoes in ten samples.

Sample	1	2	3	4	5	6	7	8	9	10
Number of sub-standard potatoes	20	15	25	15	26	28	15	12	20	24

- (a) Using these data, estimate the proportion  $p$  of sub-standard potatoes. (2)
- (b) Using graph paper and your estimated value of  $p$ , draw a fraction defective control chart showing the 95% upper warning limit and the 98% upper action limit. (7)
- (c) Plot the information from the 10 samples on the chart. (2)
- (d) Comment on the state of the process. (1)
-

6. A test was carried out to determine whether girls and boys have different abilities in solving puzzles. A random sample of 7 girls and a random sample of 5 boys were selected. Each child was given an identical puzzle to solve. The times, in seconds, taken to solve it were recorded. These times are shown in the table below.

Girls	30	26	22	38	39	20	29
Boys	23	18	17	15	27		

(a) Test, at the 5% significance level, whether or not there is a difference in the median times taken by girls and boys to solve the puzzle. State clearly your hypotheses and conclusions.

(7)

The test was then extended to a random sample of 25 girls and a random sample of 25 boys. The analysis of results using the Wilcoxon rank sum test gave the  $T$  value for the girls as 798.

(b) Stating your hypotheses and conclusions clearly test, at the 5% significance level, whether or not there is evidence that boys are quicker than girls at solving the puzzle.

(8)

---

7. It has been suggested that adding lemonade to water in which flowers are kept will prolong their life. A florist decides to compare 3 different liquids for keeping flowers fresh — water; a water and lemonade mixture; and water with special flower crystals. He has 12 bunches of flowers available for comparison.

(a) Explain how he could obtain a completely randomised design to compare the 3 liquids.

(2)

He then decides that the length of time flowers live could also depend on the type of flower as well as on the liquid that they are kept in. He has 4 different types of freshly cut flowers, *A*, *B*, *C* and *D*. He has 3 bunches of each type of flower.

(b) State the name of an experimental design the florist could use, given this extra information.

(1)

He carries out an experiment and records the number of hours the flowers live in each of the 3 liquids. The results, in coded form, are shown in the table below.

	Type			
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Water	12	13	9	10
Lemonade and water	14	15	10	9
Water and crystals	13	16	11	10

(c) Perform an analysis of variance to determine, at the 1% level of significance, whether or not there is evidence that these different liquids affect the length of time the flowers live. State your hypotheses and conclusions clearly.

(You may assume that  $12^2 + 13^2 + \dots + 11^2 + 10^2 = 1742$ )

(11)

(d) Conduct an appropriate test to see whether or not the different types of flowers live for different lengths of time.

(3)

---

**END**