Edexcel GCE

Statistics S6/S60

Advanced/Advanced Subsidiary

Wednesday 1 February 2006 – Morning

Time: 1 hour 30 minutes

Materials required for examination	Items included with question papers
Answer Book (AB16)	Nil
Graph Paper (ASG2)	
Mathematical Formulae and	
Statistical Tables (Lilac)	

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/S60), the paper reference (6688 or 6692), your surname, other names 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.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2).**
There are 7 questions in this question paper. The total mark for this paper is 75.
There are 4 pages in this paper. Any blank pages are indicated.

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.

Turn over

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1. (a) Explain what is meant by a randomised block design.

(2)

A randomised block design has 4 treatments and 5 blocks.

(b) State the number of degrees of freedom associated with the residual sum of squares.

(1)

(c) Write down the critical value of F that would be used in testing the null hypothesis that there is no difference between the treatments at the 1% significance level.

(2)

(Total 5 marks)

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2. As a result of an experiment a student collected 10 pairs of (x,y) observations and calculated the equation of the regression line to be

$$y = 0.543 + 0.631x.$$

Test at the 1% significance level, whether or not the population regression coefficient is greater than 0.55. You may assume that $S_{xx} = 2.4137$ and that the residual sum of squares is 0.145.

(Total 6 marks)

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3. The median number of clients per month seen by a therapist is claimed to be 45. From past records a random sample of 10 months was taken and the numbers of clients seen each month were recorded. The results are given below.

33   36   48   43   37   23   40   51   38   46

Use a Wilcoxon signed–ranks test to determine, at the 5% significance level, whether or not the median number of clients seen per month is 45. State your hypotheses and conclusions clearly.

(Total 8 marks)

4. A farmer carried out an experiment using 12 plots of equal size to study the effect on the yield of 4 different varieties of potato and using 3 different fertilisers. Each plot contained only one type of potato and only one type of fertiliser was used on each plot. The yield of potatoes per plot, in kg, is given in the table.

| | | Type of fertiliser | | | |
		I	II	III	Totals
Variety of potato	A	107	144	137	388
	B	140	137	145	422
	C	118	152	144	414
	D	144	154	158	456
Totals		509	587	584	1680

(You are given that the total sum of squares is 2328 and the between varieties sum of squares is $786\frac{2}{3}$.)

(a) Test, at the 5% level of significance, whether or not the type of fertiliser affects the yield of potatoes.

(10)

(b) State two assumptions needed for the validity of your test.

(2)

(Total 12 marks)

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5. Four thermometers T_1, T_2, T_3 and T_4 were used to determine the melting point, $x°C$, of hydroquinine. The results, coded by subtracting 100 from each observation, are shown in the table.

T_1	T_2	T_3	T_4
4.0	3.0	1.5	3.5
3.0	2.0	1.0	1.0
3.5		3.0	
3.0			

You are given that $\Sigma x = 28.5$ and $\Sigma x^2 = 84.75$.

Stating your hypotheses clearly and using a 5% level of significance, test whether or not there is any difference between the readings of the thermometers.

(Total 12 marks)

6. A random sample of 5 boys from Class *A* was selected and each boy was given the same puzzle to solve. The number of minutes, to the nearest minute, taken by each boy to solve the puzzle was recorded and the results are shown below.

Class *A*:   12   15   7   9   10

Similarly, a random sample of 6 girls was taken from Class *B* and their times to solve the same puzzle are recorded below.

Class *B*:   11   21   17   16   14   19

(a) Give a reason to justify using Wilcoxon rank sum test to test whether or not there is any difference between the median times taken by these children.

(1)

(b) Stating clearly your hypotheses, carry out this test using a 5% level of significance.

(7)

Eventually a random sample of 25 boys and 25 girls were given the puzzle to solve. The T value obtained for the boys was 522.

(c) Again using Wilcoxon rank sum test and a 5% level of significance, test whether or not there is any difference between the boys and the girls in terms of the median times taken to solve this puzzle.

(7)

(Total 15 marks)

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7. A machine is set to fill capsules with a particular drug. The distribution of the weights of the fillings is specified to be the normal distribution with mean 12.00g and standard deviation 0.35g.

(a) Using graph paper, draw a control chart for the sample mean, indicating 98% warning limits and 99% action limits, assuming that samples of size 10 will be taken.

(8)

(b) On three separate occasions when the chart was in use, the following values of the mean of samples of size 10 were recorded.

(i) 12.27,   (ii) 11.68,   (iii) 12.17.

In each case plot the point on your chart and in each case comment on the state of the filling process.

(4)

On another occasion when the chart was in use a random sample of size 10 was taken and the variance of this sample was found to be $0.12g^2$.

(c) Calculate a 95% confidence interval for the variance of the population of fillings from which this sample was taken.

(5)

(Total 17 marks)

TOTAL FOR PAPER: 75 MARKS

END