Paper Reference(s)

6685/01 6691/01

Edexcel GCE

Statistics S3

Advanced/Advanced Subsidiary

Friday 27 January 2006 – Afternoon

Time: 1 hour 30 minutes

Materials required for examination
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 S3), the paper reference (6685 or 6691), 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.
The marks for individual questions and the parts of questions are shown in round brackets: e.g. **(2)**.
There are 7 questions on this paper. The total mark for this paper is 75.

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.

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1. A school has 15 classes and a sixth form. In each class there are 30 students. In the sixth form there are 150 students. There are equal numbers of boys and girls in each class. There are equal numbers of boys and girls in the sixth form. The head teacher wishes to obtain the opinions of the students about school uniforms.

Explain how the head teacher would take a stratified sample of size 40.

(7)

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2. A workshop makes two types of electrical resistor.

The resistance, X ohms, of resistors of Type A is such that $X \sim N(20, 4)$.

The resistance, Y ohms, of resistors of Type B is such that $Y \sim N(10, 0.84)$.

When a resistor of each type is connected into a circuit, the resistance R ohms of the circuit is given by $R = X + Y$ where X and Y are independent.

Find

(a) E(R),

(1)

(b) Var(R),

(2)

(c) P($28.9 < R < 32.64$)

(6)

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3. The drying times of paint can be assumed to be normally distributed. A paint manufacturer paints 10 test areas with a new paint. The following drying times, to the nearest minute, were recorded.

82, 98, 140, 110, 90, 125, 150, 130, 70, 110.

(a) Calculate unbiased estimates for the mean and the variance of the population of drying times of this paint.

(5)

Given that the population standard deviation is 25,

(b) find a 95% confidence interval for the mean drying time of this paint.

(5)

Fifteen similar sets of tests are done and the 95% confidence interval is determined for each set.

(c) Estimate the expected number of these 15 intervals that will enclose the true value of the population mean μ.

(2)

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4. People over the age of 65 are offered an annual flu injection. A health official took a random sample from a list of patients who were over 65. She recorded their gender and whether or not the offer of an annual flu injection was accepted or rejected. The results are summarised below.

Gender	Accepted	Rejected
Male	170	110
Female	280	140

Using a 5% significance level, test whether or not there is an association between gender and acceptance or rejection of an annual flu injection. State your hypotheses clearly.

(9)

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5. Upon entering a school, a random sample of eight girls and an independent random sample of eighty boys were given the same examination in mathematics. The girls and boys were then taught in separate classes. After one year, they were all given another common examination in mathematics.

The means and standard deviations of the boys' and the girls' marks are shown in the table.

Examination marks				
	Upon entry		After 1 year	
	Mean	Standard deviation	Mean	Standard deviation
Boys	50	12	59	6
Girls	53	12	62	6

You may assume that the test results are normally distributed.

(*a*) Test, at the 5% level of significance, whether or not the difference between the means of the boys' and girls' results was significant when they entered school.

(7)

(*b*) Test, at the 5% level of significance, whether or not the mean mark of the boys is significantly less than the mean mark of the girls in the 'After 1 year' examination.

(5)

(*c*) Interpret the results found in part (*a*) and part (*b*).

(1)

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6. An area of grass was sampled by placing a 1 m × 1 m square randomly in 100 places. The numbers of daisies in each of the squares were counted. It was decided that the resulting data could be modelled by a Poisson distribution with mean 2. The expected frequencies were calculated using the model.

The following table shows the observed and expected frequencies.

Number of daisies	Observed frequency	Expected frequency
0	8	13.53
1	32	27.07
2	27	r
3	18	s
4	10	9.02
5	3	3.61
6	1	1.20
7	0	0.34
≥ 8	1	t

(*a*) Find values for r, s and t.

(4)

(*b*) Using a 5% significance level, test whether or not this Poisson model is suitable. State your hypotheses clearly.

(7)

An alternative test might have been to estimate the population mean by using the data given.

(*c*) Explain how this would have affected the test.

(2)

7. The numbers of deaths from pneumoconiosis and lung cancer in a developing country are given in the table.

Age group (years)	20–29	30–39	40–49	50–59	60–69	70 and over
Deaths from pneumoconiosis (1000s)	12.5	5.9	18.5	19.4	31.2	31.0
Deaths from lung cancer (1000s)	3.7	9.0	10.2	19.0	13.0	18.0

The correlation between the number of deaths in the different age groups for each disease is to be investigated.

(*a*) Give **one** reason why Spearman's rank correlation coefficient should be used.

(1)

(*b*) Calculate Spearman's rank correlation coefficient for these data.

(6)

(*c*) Use a suitable test, at the 5% significance level, to interpret your result. State your hypotheses clearly.

(5)

TOTAL FOR PAPER: 75 MARKS

END