June 2011

Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	9	1	/	0	1	Signature	

Paper Reference(s)

6691/01

Edexcel GCE

Statistics S3

Advanced/Advanced Subsidiary

Monday 20 June 2011 – Morning

Time: 1 hour 30 minutes

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
Total	

Materials required for examination
Mathematical Formulae (Pink)

Items included with question papers
Nil

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation or symbolic differentiation/integration, or have retrievable mathematical formulae stored in them.

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initials and signature.
Check that you have the correct question paper.
Answer ALL the questions.
You must write your answer to each question in the space following the question.
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 24 pages in this question paper. Any blank pages are indicated.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You should show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.

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1. Explain what you understand by the Central Limit Theorem.

(3)

Q1

(Total 3 marks)

Leave blank

2. A county councillor is investigating the level of hardship, *h*, of a town and the number of calls per 100 people to the emergency services, *c*. He collects data for 7 randomly selected towns in the county. The results are shown in the table below.

Town	*A*	*B*	*C*	*D*	*E*	*F*	*G*
h	14	20	16	18	37	19	24
c	52	45	43	42	61	82	55

(a) Calculate the Spearman's rank correlation coefficient between *h* and *c*.

(6)

After collecting the data, the councillor thinks there is no correlation between hardship and the number of calls to the emergency services.

(b) Test, at the 5% level of significance, the councillor's claim. State your hypotheses clearly.

(4)

Leave blank

3. A factory manufactures batches of an electronic component. Each component is manufactured in one of three shifts. A component may have one of two types of defect, D_1 or D_2, at the end of the manufacturing process. A production manager believes that the type of defect is dependent upon the shift that manufactured the component. He examines 200 randomly selected defective components and classifies them by defect type and shift. The results are shown in the table below.

Defect type / Shift	D_1	D_2
First shift	45	18
Second shift	55	20
Third shift	50	12

Stating your hypotheses, test, at the 10% level of significance, whether or not there is evidence to support the manager's belief. Show your working clearly.

(10)

Leave blank

Question 3 continued

Leave blank

4. A shop manager wants to find out if customers spend more money when music is playing in the shop. The amount of money spent by a customer in the shop is £x. A random sample of 80 customers, who were shopping without music playing, and an independent random sample of 60 customers, who were shopping with music playing, were surveyed. The results of both samples are summarised in the table below.

	$\sum x$	$\sum x^2$	Unbiased estimate of mean	Unbiased estimate of variance
Customers shopping **without** music	5 320	392 000	$\overline{x}$	s^2
Customers shopping **with** music	4 140	312 000	69.0	446.44

(a) Find the values of $\overline{x}$ and s^2.

(5)

(b) Test, at the 5% level of significance, whether or not the mean money spent is greater when music is playing in the shop. State your hypotheses clearly.

(8)

Leave blank

Question 4 continued

Leave blank

5. The number of hurricanes per year in a particular region was recorded over 80 years. The results are summarised in Table 1 below.

No of hurricanes, h	0	1	2	3	4	5	6	7
Frequency	0	2	5	17	20	12	12	12

Table 1

(a) Write down two assumptions that will support modelling the number of hurricanes per year by a Poisson distribution.

(2)

(b) Show that the mean number of hurricanes per year from Table 1 is 4.4875

(2)

(c) Use the answer in part (b) to calculate the expected frequencies r and s given in Table 2 below to 2 decimal places.

(3)

h	0	1	2	3	4	5	6	7 or more
Expected frequency	0.90	4.04	r	13.55	s	13.65	10.21	13.39

Table 2

(d) Test, at the 5% level of significance, whether or not the data can be modelled by a Poisson distribution. State your hypotheses clearly.

(6)

Leave blank

Question 5 continued

Leave blank

6. The lifetimes of batteries from manufacturer *A* are normally distributed with mean 20 hours and standard deviation 5 hours when used in a camera.

(a) Find the mean and standard deviation of the total lifetime of a pack of 6 batteries from manufacturer *A*.

(2)

Judy uses a camera that takes one battery at a time. She takes a pack of 6 batteries from manufacturer *A* to use in her camera on holiday.

(b) Find the probability that the batteries will last for more than 110 hours on her holiday.

(2)

The lifetimes of batteries from manufacturer *B* are normally distributed with mean 35 hours and standard deviation 8 hours when used in a camera.

(c) Find the probability that the total lifetime of a pack of 6 batteries from manufacturer *A* is more than 4 times the lifetime of a single battery from manufacturer *B* when used in a camera.

(6)

Leave blank

Question 6 continued

Q6

(Total 10 marks)

Leave blank

7. Roastie's Coffee is sold in packets with a stated weight of 250 g. A supermarket manager claims that the mean weight of the packets is less than the stated weight. She weighs a random sample of 90 packets from their stock and finds that their weights have a mean of 248 g and a standard deviation of 5.4 g.

(a) Using a 5% level of significance, test whether or not the manager's claim is justified. State your hypotheses clearly.

(5)

(b) Find the 98% confidence interval for the mean weight of a packet of coffee in the supermarket's stock.

(4)

(c) State, with a reason, the action you would recommend the manager to take over the weight of a packet of Roastie's Coffee.

(2)

Roastie's Coffee company increase the mean weight of their packets to μ g and reduce the standard deviation to 3 g. The manager takes a sample of size n from these new packets. She uses the sample mean $\bar{X}$ as an estimator of μ.

(d) Find the minimum value of n such that $\mathrm{P}(|\bar{X} - \mu| < 1) \geqslant 0.98$

(5)

Leave blank

Question 7 continued