January 2013

Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	6	8	4	/	0	1	Signature	

Paper Reference(s)

6684/01

Edexcel GCE

Statistics S2

Advanced/Advanced Subsidiary

Friday 18 January 2013 – Afternoon

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 28 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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PEARSON

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1. (a) Write down the conditions under which the Poisson distribution can be used as an approximation to the binomial distribution.

(2)

The probability of any one letter being delivered to the wrong house is 0.01
On a randomly selected day Peter delivers 1000 letters.

(b) Using a Poisson approximation, find the probability that Peter delivers at least 4 letters to the wrong house.

Give your answer to 4 decimal places.

(3)

Leave blank

2. In a village, power cuts occur randomly at a rate of 3 per year.

(a) Find the probability that in any given year there will be

(i) exactly 7 power cuts,

(ii) at least 4 power cuts.

(5)

(b) Use a suitable approximation to find the probability that in the next 10 years the number of power cuts will be less than 20

(6)

Leave blank

Question 2 continued

Leave blank

3. A random variable X has the distribution B(12, p).

(a) Given that $p = 0.25$ find

(i) $P(X < 5)$

(ii) $P(X \geqslant 7)$

(3)

(b) Given that $P(X = 0) = 0.05$, find the value of p to 3 decimal places.

(3)

(c) Given that the variance of X is 1.92, find the possible values of p.

(4)

Leave blank

Question 3 continued

Leave blank

4. The continuous random variable X is uniformly distributed over the interval $[-4, 6]$.

(a) Write down the mean of X.

(1)

(b) Find $\mathrm{P}(X \leqslant 2.4)$

(2)

(c) Find $\mathrm{P}(-3 < X - 5 < 3)$

(2)

The continuous random variable Y is uniformly distributed over the interval $[a, 4a]$.

(d) Use integration to show that $\mathrm{E}(Y^2) = 7a^2$

(4)

(e) Find $\mathrm{Var}(Y)$.

(2)

(f) Given that $\mathrm{P}(X < \frac{8}{3}) = \mathrm{P}(Y < \frac{8}{3})$, find the value of a.

(3)

Leave blank

Question 4 continued

Leave blank

5. The continuous random variable T is used to model the number of days, t, a mosquito survives after hatching.

The probability that the mosquito survives for more than t days is

$$\frac{225}{(t+15)^2}, \quad t \geqslant 0$$

(a) Show that the cumulative distribution function of T is given by

$$\mathrm{F}(t) = \begin{cases} 1 - \dfrac{225}{(t+15)^2} & t \geqslant 0 \\ 0 & \text{otherwise} \end{cases}$$

(1)

(b) Find the probability that a randomly selected mosquito will die within 3 days of hatching.

(2)

(c) Given that a mosquito survives for 3 days, find the probability that it will survive for at least 5 more days.

(3)

A large number of mosquitoes hatch on the same day.

(d) Find the number of days after which only 10% of these mosquitoes are expected to survive.

(4)

Leave blank

Question 5 continued

Leave blank

6. (a) Explain what you understand by a hypothesis.

(1)

(b) Explain what you understand by a critical region.

(2)

Mrs George claims that 45% of voters would vote for her.

In an opinion poll of 20 randomly selected voters it was found that 5 would vote for her.

(c) Test at the 5% level of significance whether or not the opinion poll provides evidence to support Mrs George's claim.

(4)

In a second opinion poll of n randomly selected people it was found that no one would vote for Mrs George.

(d) Using a 1% level of significance, find the smallest value of n for which the hypothesis $H_0 : p = 0.45$ will be rejected in favour of $H_1 : p < 0.45$

(3)

Leave blank

Question 6 continued

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7. The continuous random variable X has the following probability density function

$$f(x) = \begin{cases} a + bx & 0 \leqslant x \leqslant 5 \\ 0 & \text{otherwise} \end{cases}$$

where a and b are constants.

(a) Show that $10a + 25b = 2$

(4)

Given that $E(X) = \frac{35}{12}$

(b) find a second equation in a and b,

(3)

(c) hence find the value of a and the value of b.

(3)

(d) Find, to 3 significant figures, the median of X.

(3)

(e) Comment on the skewness. Give a reason for your answer.

(2)

Leave blank

Question 7 continued