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

Tuesday 24 June 2014 – 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	
Total	

Materials required for examination	Items included with question papers
Mathematical Formulae (Pink)	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 6 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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PEARSON

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1. Patients arrive at a hospital accident and emergency department at random at a rate of 6 per hour.

(a) Find the probability that, during any 90 minute period, the number of patients arriving at the hospital accident and emergency department is

(i) exactly 7

(ii) at least 10

(5)

A patient arrives at 11.30 a.m.

(b) Find the probability that the next patient arrives before 11.45 a.m.

(3)

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Question 1 continued

Q1

(Total 8 marks)

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2. The length of time, in minutes, that a customer queues in a Post Office is a random variable, T, with probability density function

$$f(t) = \begin{cases} c(81 - t^2) & 0 \leqslant t \leqslant 9 \\ 0 & \text{otherwise} \end{cases}$$

where c is a constant.

(a) Show that the value of c is $\dfrac{1}{486}$

(4)

(b) Show that the cumulative distribution function $F(t)$ is given by

$$F(t) = \begin{cases} 0 & t < 0 \\ \dfrac{t}{6} - \dfrac{t^3}{1458} & 0 \leqslant t \leqslant 9 \\ 1 & t > 9 \end{cases}$$

(2)

(c) Find the probability that a customer will queue for longer than 3 minutes.

(2)

A customer has been queueing for 3 minutes.

(d) Find the probability that this customer will be queueing for at least 7 minutes.

(3)

Three customers are selected at random.

(e) Find the probability that exactly 2 of them had to queue for longer than 3 minutes.

(3)

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Question 2 continued

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Question 2 continued

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Question 2 continued

Q2

(Total 14 marks)

P 4 3 1 7 2 A 0 7 2 4

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3. A company claims that it receives emails at a mean rate of 2 every 5 minutes.

(a) Give two reasons why a Poisson distribution could be a suitable model for the number of emails received.
(2)

(b) Using a 5% level of significance, find the critical region for a two-tailed test of the hypothesis that the mean number of emails received in a 10 minute period is 4. The probability of rejection in each tail should be as close as possible to 0.025
(2)

(c) Find the actual level of significance of this test.
(2)

To test this claim, the number of emails received in a random 10 minute period was recorded.

During this period 8 emails were received.

(d) Comment on the company's claim in the light of this value. Justify your answer.
(2)

During a randomly selected 15 minutes of play in the Wimbledon Men's Tennis Tournament final, 2 emails were received by the company.

(e) Test, at the 10% level of significance, whether or not the mean rate of emails received by the company during the Wimbledon Men's Tennis Tournament final is lower than the mean rate received at other times. State your hypotheses clearly.
(5)

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Question 3 continued

Leave blank

Question 3 continued

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Question 3 continued

Q3

(Total 13 marks)

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4. A cadet fires shots at a target at distances ranging from 25 m to 90 m. The probability of hitting the target with a single shot is p. When firing from a distance d m, $p = \frac{3}{200}(90 - d)$.

Each shot is fired independently.

The cadet fires 10 shots from a distance of 40 m.

(a) (i) Find the probability that exactly 6 shots hit the target.

(ii) Find the probability that at least 8 shots hit the target.

(5)

The cadet fires 20 shots from a distance of x m.

(b) Find, to the nearest integer, the value of x if the cadet has an 80% chance of hitting the target at least once.

(4)

The cadet fires 100 shots from 25 m.

(c) Using a suitable approximation, estimate the probability that at least 95 of these shots hit the target.

(5)

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Question 4 continued

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Question 4 continued

Leave blank

Question 4 continued

Q4

(Total 14 marks)

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5. (a) State the conditions under which the normal distribution may be used as an approximation to the binomial distribution.

(2)

A company sells seeds and claims that 55% of its pea seeds germinate.

(b) Write down a reason why the company should not justify their claim by testing all the pea seeds they produce.

(1)

To test the company's claim, a random sample of 220 pea seeds was planted.

(c) State the hypotheses for a two-tailed test of the company's claim.

(1)

Given that 135 of the 220 pea seeds germinated,

(d) use a normal approximation to test, at the 5% level of significance, whether or not the company's claim is justified.

(7)

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Question 5 continued

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Question 5 continued

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Question 5 continued

Q5

(Total 11 marks)

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6. The continuous random variable X has probability density function f(x) given by

$$\mathrm{f}(x) = \begin{cases} \dfrac{2x}{9} & 0 \leqslant x \leqslant 1 \\ \dfrac{2}{9} & 1 < x < 4 \\ \dfrac{2}{3} - \dfrac{x}{9} & 4 \leqslant x \leqslant 6 \\ 0 & \text{otherwise} \end{cases}$$

(a) Find E(X).

(4)

(b) Find the cumulative distribution function F(x) for all values of x.

(6)

(c) Find the median of X.

(3)

(d) Describe the skewness. Give a reason for your answer.

(2)

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Question 6 continued

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Question 6 continued

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Question 6 continued

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Question 6 continued

Q6

(Total 15 marks)

TOTAL FOR PAPER: 75 MARKS

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