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

Monday 11 June 2007 – 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	
8	
Total	

Materials required for examination	**Items included with question papers**
Mathematical Formulae (Green)	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, differentiation and integration, or have retrievable mathematical formulas 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. Write your answer for 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 8 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 must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.

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1. A string AB of length 5 cm is cut, in a random place C, into two pieces. The random variable X is the length of AC.

(a) Write down the name of the probability distribution of X and sketch the graph of its probability density function.

(3)

(b) Find the values of $E(X)$ and $Var(X)$.

(3)

(c) Find $P(X > 3)$.

(1)

(d) Write down the probability that AC is 3 cm long.

(1)

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Question 1 continued

Q1

(Total 8 marks)

Turn over

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2. Bacteria are randomly distributed in a river at a rate of 5 per litre of water. A new factory opens and a scientist claims it is polluting the river with bacteria. He takes a sample of 0.5 litres of water from the river near the factory and finds that it contains 7 bacteria. Stating your hypotheses clearly test, at the 5% level of significance, the claim of the scientist.
(7)

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Question 2 continued

(Total 7 marks)

Q2

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3. An engineering company manufactures an electronic component. At the end of the manufacturing process, each component is checked to see if it is faulty.
Faulty components are detected at a rate of 1.5 per hour.

(a) Suggest a suitable model for the number of faulty components detected per hour.
(1)

(b) Describe, in the context of this question, two assumptions you have made in part (a) for this model to be suitable.
(2)

(c) Find the probability of 2 faulty components being detected in a 1 hour period.
(2)

(d) Find the probability of at least one faulty component being detected in a 3 hour period.
(3)

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Question 3 continued

Q3

(Total 8 marks)

N 2 6 1 1 9 A 0 7 2 4

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4. A bag contains a large number of coins:

75% are 10p coins,

25% are 5p coins.

A random sample of 3 coins is drawn from the bag.
Find the sampling distribution for the median of the values of the 3 selected coins.
(7)

N 2 6 1 1 9 A 0 8 2 4

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Question 4 continued

(Total 7 marks)

Q4

N 2 6 1 1 9 A 0 9 2 4

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5. (a) Write down the conditions under which the Poisson distribution may be used as an approximation to the Binomial distribution.
(2)

A call centre routes incoming telephone calls to agents who have specialist knowledge to deal with the call. The probability of the caller being connected to the wrong agent is 0.01

(b) Find the probability that 2 consecutive calls will be connected to the wrong agent.
(2)

(c) Find the probability that more than 1 call in 5 consecutive calls are connected to the wrong agent.
(3)

The call centre receives 1000 calls each day.

(d) Find the mean and variance of the number of wrongly connected calls.
(3)

(e) Use a Poisson approximation to find, to 3 decimal places, the probability that more than 6 calls each day are connected to the wrong agent.
(2)

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Question 5 continued

N 2 6 1 1 9 A 0 1 1 2 4

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Question 5 continued

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Question 5 continued

(Total 12 marks)

Q5

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6. Linda regularly takes a taxi to work five times a week. Over a long period of time she finds the taxi is late once a week. The taxi firm changes her driver and Linda thinks the taxi is late more often. In the first week, with the new driver, the taxi is late 3 times.

You may assume that the number of times a taxi is late in a week has a Binomial distribution.

Test, at the 5% level of significance, whether or not there is evidence of an increase in the proportion of times the taxi is late. State your hypotheses clearly.

(7)

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Question 6 continued

(Total 7 marks)

Q6

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7. (a) (i) Write down two conditions for $X \sim \text{Bin}(n, p)$ to be approximated by a normal distribution $Y \sim \text{N}(\mu, \sigma^2)$.

(2)

(ii) Write down the mean and variance of this normal approximation in terms of n and p.

(2)

A factory manufactures 2000 DVDs every day. It is known that 3% of DVDs are faulty.

(b) Using a normal approximation, estimate the probability that at least 40 faulty DVDs are produced in one day.

(5)

The quality control system in the factory identifies and destroys every faulty DVD at the end of the manufacturing process. It costs £0.70 to manufacture a DVD and the factory sells non-faulty DVDs for £11.

(c) Find the expected profit made by the factory per day.

(3)

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Question 7 continued

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Question 7 continued

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Question 7 continued

(Total 12 marks)

Q7

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8. The continuous random variable X has probability density function given by

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

(a) Sketch the probability density function of X.

(3)

(b) Find the mode of X.

(1)

(c) Specify fully the cumulative distribution function of X.

(7)

(d) Using your answer to part (c), find the median of X.

(3)

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Question 8 continued

Turn over

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Question 8 continued

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Question 8 continued

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Question 8 continued

Q8

(Total 14 marks)

TOTAL FOR PAPER: 75 MARKS

END

N 2 6 1 1 9 A 0 2 4 2 4