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

Thursday 26 May 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 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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1. A factory produces components. Each component has a unique identity number and it is assumed that 2% of the components are faulty. On a particular day, a quality control manager wishes to take a random sample of 50 components.

(a) Identify a sampling frame.

(1)

The statistic F represents the number of faulty components in the random sample of size 50.

(b) Specify the sampling distribution of F.

(2)

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Question 1 continued

(Total 3 marks)

Q1

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2. A traffic officer monitors the rate at which vehicles pass a fixed point on a motorway. When the rate exceeds 36 vehicles per minute he must switch on some speed restrictions to improve traffic flow.

(a) Suggest a suitable model to describe the number of vehicles passing the fixed point in a 15 s interval.

(1)

The traffic officer records 12 vehicles passing the fixed point in a 15 s interval.

(b) Stating your hypotheses clearly, and using a 5% level of significance, test whether or not the traffic officer has sufficient evidence to switch on the speed restrictions.

(6)

(c) Using a 5% level of significance, determine the smallest number of vehicles the traffic officer must observe in a 10 s interval in order to have sufficient evidence to switch on the speed restrictions.

(3)

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Question 2 continued

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Question 2 continued

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Question 2 continued

Q2

(Total 10 marks)

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3.

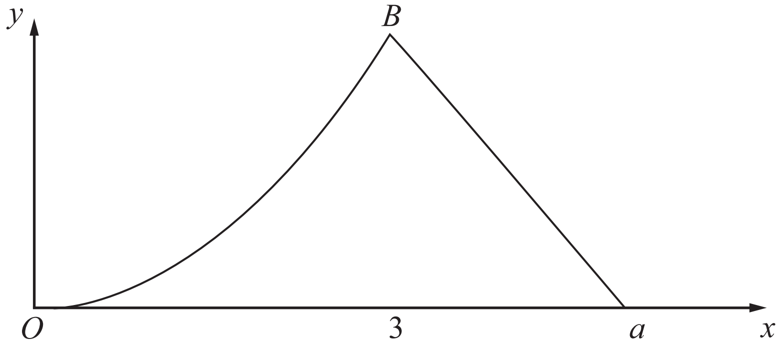

Figure 1

Figure 1 shows a sketch of the probability density function $\mathrm{f}(x)$ of the random variable X.

For $0 \leqslant x \leqslant 3$, $\mathrm{f}(x)$ is represented by a curve OB with equation $\mathrm{f}(x) = kx^2$, where k is a constant.

For $3 \leqslant x \leqslant a$, where a is a constant, $\mathrm{f}(x)$ is represented by a straight line passing through B and the point $(a, 0)$.

For all other values of x, $\mathrm{f}(x) = 0$.

Given that the mode of X = the median of X, find

(a) the mode,

(1)

(b) the value of k,

(4)

(c) the value of a.

(3)

Without calculating $\mathrm{E}(X)$ and with reference to the skewness of the distribution

(d) state, giving your reason, whether $\mathrm{E}(X) < 3$, $\mathrm{E}(X) = 3$ or $\mathrm{E}(X) > 3$.

(2)

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Question 3 continued

P 3 8 1 6 5 A 0 9 2 8

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Question 3 continued

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Question 3 continued

(Total 10 marks)

Q3

P 3 8 1 6 5 A 0 1 1 2 8

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4. In a game, players select sticks at random from a box containing a large number of sticks of different lengths. The length, in cm, of a randomly chosen stick has a continuous uniform distribution over the interval [7, 10].

A stick is selected at random from the box.

(a) Find the probability that the stick is shorter than 9.5 cm.

(2)

To win a bag of sweets, a player must select 3 sticks and wins if the length of the longest stick is more than 9.5 cm.

(b) Find the probability of winning a bag of sweets.

(2)

To win a soft toy, a player must select 6 sticks and wins the toy if more than four of the sticks are shorter than 7.6 cm.

(c) Find the probability of winning a soft toy.

(4)

Leave blank

Question 4 continued

(Total 8 marks)

Q4

P 3 8 1 6 5 A 0 1 3 2 8

Turn over

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5. Defects occur at random in planks of wood with a constant rate of 0.5 per 10 cm length. Jim buys a plank of length 100 cm.

(a) Find the probability that Jim's plank contains at most 3 defects.

(2)

Shivani buys 6 planks each of length 100 cm.

(b) Find the probability that fewer than 2 of Shivani's planks contain at most 3 defects.

(5)

(c) Using a suitable approximation, estimate the probability that the total number of defects on Shivani's 6 planks is less than 18.

(6)

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Question 5 continued

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Question 5 continued

Question 5 continued

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Q5

(Total 13 marks)

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6. A shopkeeper knows, from past records, that 15% of customers buy an item from the display next to the till. After a refurbishment of the shop, he takes a random sample of 30 customers and finds that only 1 customer has bought an item from the display next to the till.

(a) Stating your hypotheses clearly, and using a 5% level of significance, test whether or not there has been a change in the proportion of customers buying an item from the display next to the till.

(6)

During the refurbishment a new sandwich display was installed. Before the refurbishment 20% of customers bought sandwiches. The shopkeeper claims that the proportion of customers buying sandwiches has now increased. He selects a random sample of 120 customers and finds that 31 of them have bought sandwiches.

(b) Using a suitable approximation and stating your hypotheses clearly, test the shopkeeper's claim. Use a 10% level of significance.

(8)

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Question 6 continued

Turn over

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Question 6 continued

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Question 6 continued

(Total 14 marks)

Q6

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

$$\mathrm{f}(x)=\begin{cases}\frac{3}{32}(x-1)(5-x) & 1\leqslant x\leqslant 5\\ 0 & \text{otherwise}\end{cases}$$

(a) Sketch $\mathrm{f}(x)$ showing clearly the points where it meets the x-axis.

(2)

(b) Write down the value of the mean, μ, of X.

(1)

(c) Show that $\mathrm{E}(X^2)=9.8$

(4)

(d) Find the standard deviation, σ, of X.

(2)

The cumulative distribution function of X is given by

$$\mathrm{F}(x)=\begin{cases}0 & x<1\\ \frac{1}{32}\left(a-15x+9x^2-x^3\right) & 1\leqslant x\leqslant 5\\ 1 & x>5\end{cases}$$

where a is a constant.

(e) Find the value of a.

(2)

(f) Show that the lower quartile of X, q_1, lies between 2.29 and 2.31

(3)

(g) Hence find the upper quartile of X, giving your answer to 1 decimal place.

(1)

(h) Find, to 2 decimal places, the value of k so that

$$\mathrm{P}(\mu-k\sigma<X<\mu+k\sigma)=0.5$$

(2)

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Question 7 continued

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Question 7 continued

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Question 7 continued

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Question 7 continued

Q7

(Total 17 marks)

TOTAL FOR PAPER: 75 MARKS

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