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

Paper Reference(s)

6684/01R

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	
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. Before Roger will use a tennis ball he checks it using a "bounce" test. The probability that a ball from Roger's usual supplier fails the bounce test is 0.2. A new supplier claims that the probability of one of their balls failing the bounce test is less than 0.2. Roger checks a random sample of 40 balls from the new supplier and finds that 3 balls fail the bounce test.

Stating your hypotheses clearly, use a 5% level of significance to test the new supplier's claim.

(5)

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2. A bag contains a large number of counters. Each counter has a single digit number on it and the mean of all the numbers in the bag is the unknown parameter μ. The number 2 is on 40% of the counters and the number 5 is on 25% of the counters. All the remaining counters have numbers greater than 5 on them.

A random sample of 10 counters is taken from the bag.

(a) State whether or not each of the following is a statistic

(i) S = the sum of the numbers on the counters in the sample,

(ii) D = the difference between the highest number in the sample and μ,

(iii) F = the number of counters in the sample with a number 5 on them.

(3)

The random variable T represents the number of counters in a random sample of 10 with the number 2 on them.

(b) Specify the sampling distribution of T.

(2)

The counters are selected one by one.

(c) Find the probability that the third counter selected is the first counter with the number 2 on it.

(2)

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3. Accidents occur randomly at a road junction at a rate of 18 every year.
The random variable X represents the number of accidents at this road junction in the next 6 months.

(a) Write down the distribution of X.

(2)

(b) Find $P(X > 7)$.

(2)

(c) Show that the probability of at least one accident in a randomly selected month is 0.777 (correct to 3 decimal places).

(3)

(d) Find the probability that there is at least one accident in exactly 4 of the next 6 months.

(3)

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4. The random variable X has probability density function $\mathrm{f}(x)$ given by

$$\mathrm{f}(x) = \begin{cases} 3k & 0 \leqslant x < 1 \\ kx(4 - x) & 1 \leqslant x \leqslant 4 \\ 0 & \text{otherwise} \end{cases}$$

where k is a constant.

(a) Sketch $\mathrm{f}(x)$.

(3)

(b) Write down the mode of X.

(1)

Given that $\mathrm{E}(X) = \dfrac{29}{16}$

(c) describe, giving a reason, the skewness of the distribution.

(2)

(d) Use integration to find the value of k.

(5)

(e) Write down the lower quartile of X.

(1)

Given also that $\mathrm{P}(2 < X < 3) = \dfrac{11}{36}$

(f) find the exact value of $\mathrm{P}(X > 3)$.

(2)

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Question 4 continued

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5. Sammy manufactures wallpaper. She knows that defects occur randomly in the manufacturing process at a rate of 1 every 8 metres. Once a week the machinery is cleaned and reset. Sammy then takes a random sample of 40 metres of wallpaper from the next batch produced to test if there has been any change in the rate of defects.

(a) Stating your hypotheses clearly and using a 10% level of significance, find the critical region for this test. You should choose your critical region so that the probability of rejection is less than 0.05 in each tail.

(4)

(b) State the actual significance level of this test.

(2)

Thomas claims that his new machine would reduce the rate of defects and invites Sammy to test it. Sammy takes a random sample of 200 metres of wallpaper produced on Thomas' machine and finds 19 defects.

(c) Using a suitable approximation, test Thomas' claim. You should use a 5% level of significance and state your hypotheses clearly.

(7)

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Question 5 continued

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6. In an experiment some children were asked to estimate the position of the centre of a circle. The random variable D represents the distance, in centimetres, between the child's estimate and the actual position of the centre of the circle. The cumulative distribution function of D is given by

$$\mathrm{F}(d) = \begin{cases} 0 & d < 0 \\ \dfrac{d^2}{2} - \dfrac{d^4}{16} & 0 \leqslant d \leqslant 2 \\ 1 & d > 2 \end{cases}$$

(a) Find the median of D.

(4)

(b) Find the mode of D.

Justify your answer.

(5)

The experiment is conducted on 80 children.

(c) Find the expected number of children whose estimate is less than 1 cm from the actual centre of the circle.

(3)

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Question 6 continued

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7. A piece of string AB has length 9 cm. The string is cut at random at a point P and the random variable X represents the length of the piece of string AP.

(a) Write down the distribution of X.

(1)

(b) Find the probability that the length of the piece of string AP is more than 6 cm.

(1)

The two pieces of string AP and PB are used to form two sides of a rectangle.

The random variable R represents the area of the rectangle.

(c) Show that $R = aX^2 + bX$ and state the values of the constants a and b.

(2)

(d) Find $\mathrm{E}(R)$.

(6)

(e) Find the probability that R is more than twice the area of a square whose side has the length of the piece of string AP.

(4)

PMT

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Question 7 continued

Q7

(Total 14 marks)

TOTAL FOR PAPER: 75 MARKS

END