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 16 January 2007 – 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 (Green)

Items included with question papers
Nil

Candidates may use any calculator EXCEPT those with the facility for symbolic algebra, differentiation and/or integration. Thus candidates may NOT use calculators such as the Texas Instruments TI 89, TI 92, Casio CFX 9970G, Hewlett Packard HP 48G.

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
Check that you have the correct question paper. You must 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.
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 question paper is 75.
There are 20 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 gain no credit.

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1. (a) Define a statistic.

(2)

A random sample $X_1, X_2, \ldots, X_n$ is taken from a population with unknown mean μ.

(b) For each of the following state whether or not it is a statistic.

(i) $\dfrac{X_1 + X_4}{2}$,

(1)

(ii) $\dfrac{\sum X^2}{n} - \mu^2$.

(1)

Q1

(Total 4 marks)

N 2 3 5 5 6 A 0 2 2 0

Leave blank

2. The random variable J has a Poisson distribution with mean 4.

(a) Find $P(J \geqslant 10)$.

(2)

The random variable K has a binomial distribution with parameters $n = 25$, $p = 0.27$.

(b) Find $P(K \leqslant 1)$.

(3)

Q2

(Total 5 marks)

Leave blank

3. For a particular type of plant 45% have white flowers and the remainder have coloured flowers. Gardenmania sells plants in batches of 12. A batch is selected at random.

Calculate the probability that this batch contains

(a) exactly 5 plants with white flowers,

(3)

(b) more plants with white flowers than coloured ones.

(2)

Gardenmania takes a random sample of 10 batches of plants.

(c) Find the probability that exactly 3 of these batches contain more plants with white flowers than coloured ones.

(3)

Due to an increasing demand for these plants by large companies, Gardenmania decides to sell them in batches of 50.

(d) Use a suitable approximation to calculate the probability that a batch of 50 plants contains more than 25 plants with white flowers.

(7)

Leave blank

Question 3 continued

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4. (a) State the condition under which the normal distribution may be used as an approximation to the Poisson distribution.

(1)

(b) Explain why a continuity correction must be incorporated when using the normal distribution as an approximation to the Poisson distribution.

(1)

A company has yachts that can only be hired for a week at a time. All hiring starts on a Saturday.
During the winter the mean number of yachts hired per week is 5.

(c) Calculate the probability that fewer than 3 yachts are hired on a particular Saturday in winter.

(2)

During the summer the mean number of yachts hired per week increases to 25.
The company has only 30 yachts for hire.

(d) Using a suitable approximation find the probability that the demand for yachts cannot be met on a particular Saturday in the summer.

(6)

In the summer there are 16 Saturdays on which a yacht can be hired.

(e) Estimate the number of Saturdays in the summer that the company will not be able to meet the demand for yachts.

(2)

Leave blank

Question 4 continued

(Total 12 marks)

Q4

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5. The continuous random variable X is uniformly distributed over the interval $\alpha < x < \beta$.

(a) Write down the probability density function of X, for all x.

(2)

(b) Given that $\mathrm{E}(X) = 2$ and $\mathrm{P}(X < 3) = \frac{5}{8}$ find the value of α and the value of β.

(4)

A gardener has wire cutters and a piece of wire 150 cm long which has a ring attached at one end. The gardener cuts the wire, at a randomly chosen point, into 2 pieces. The length, in cm, of the piece of wire with the ring on it is represented by the random variable X. Find

(c) $\mathrm{E}(X)$,

(1)

(d) the standard deviation of X,

(2)

(e) the probability that the shorter piece of wire is at most 30 cm long.

(3)

Leave blank

Question 5 continued

Leave blank

6. Past records from a large supermarket show that 20% of people who buy chocolate bars buy the family size bar. On one particular day a random sample of 30 people was taken from those that had bought chocolate bars and 2 of them were found to have bought a family size bar.

(a) Test at the 5% significance level, whether or not the proportion p, of people who bought a family size bar of chocolate that day had decreased. State your hypotheses clearly.

(6)

The manager of the supermarket thinks that the probability of a person buying a gigantic chocolate bar is only 0.02. To test whether this hypothesis is true the manager decides to take a random sample of 200 people who bought chocolate bars.

(b) Find the critical region that would enable the manager to test whether or not there is evidence that the probability is different from 0.02. The probability of each tail should be as close to 2.5% as possible.

(6)

(c) Write down the significance level of this test.

(1)

Leave blank

Question 6 continued

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7. The continuous random variable X has cumulative distribution function

$$\mathrm{F}(x) = \begin{cases} 0, & x < 0, \\ 2x^2 - x^3, & 0 \leqslant x \leqslant 1, \\ 1, & x > 1. \end{cases}$$

(a) Find $\mathrm{P}(X > 0.3)$.
(2)

(b) Verify that the median value of X lies between $x = 0.59$ and $x = 0.60$.
(3)

(c) Find the probability density function $\mathrm{f}(x)$.
(2)

(d) Evaluate $\mathrm{E}(X)$.
(3)

(e) Find the mode of X.
(2)

(f) Comment on the skewness of X. Justify your answer.
(2)

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

Leave blank

Question 7 continued