| 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

Friday 14 January 2011 – 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 | |
| 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, differentiation and 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.** A disease occurs in 3% of a population.

(a) State any assumptions that are required to model the number of people with the disease in a random sample of size $n$ as a binomial distribution.
**(2)**

(b) Using this model, find the probability of exactly 2 people having the disease in a random sample of 10 people.
**(3)**

(c) Find the mean and variance of the number of people with the disease in a random sample of 100 people.
**(2)**

A doctor tests a random sample of 100 patients for the disease. He decides to offer all patients a vaccination to protect them from the disease if more than 5 of the sample have the disease.

(d) Using a suitable approximation, find the probability that the doctor will offer all patients a vaccination.
**(3)**

Leave blank

**Question 1 continued**

Q1

**(Total 10 marks)**



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**2.** A student takes a multiple choice test. The test is made up of 10 questions each with 5 possible answers. The student gets 4 questions correct. Her teacher claims she was guessing the answers. Using a one tailed test, at the 5% level of significance, test whether or not there is evidence to reject the teacher's claim.
State your hypotheses clearly.

**(6)**

Leave blank

**Question 2 continued**

Q2

**(Total 6 marks)**

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**3.** The continuous random variable $X$ is uniformly distributed over the interval [–1,3].
Find

(a) $\mathrm{E}(X)$ **(1)**

(b) $\mathrm{Var}(X)$ **(2)**

(c) $\mathrm{E}(X^2)$ **(2)**

(d) $\mathrm{P}(X < 1.4)$ **(1)**

A total of 40 observations of $X$ are made.

(e) Find the probability that at least 10 of these observations are negative. **(5)**

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**Question 3 continued**



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**Question 3 continued**

Leave blank

**Question 3 continued**

Q3

**(Total 11 marks)**



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**4.** Richard regularly travels to work on a ferry. Over a long period of time, Richard has found that the ferry is late on average 2 times every week. The company buys a new ferry to improve the service. In the 4-week period after the new ferry is launched, Richard finds the ferry is late 3 times and claims the service has improved. Assuming that the number of times the ferry is late has a Poisson distribution, test Richard's claim at the 5% level of significance. State your hypotheses clearly.

**(6)**

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**Question 4 continued**

Q4

**(Total 6 marks)**



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**5.** A continuous random variable $X$ has the probability density function $\mathrm{f}(x)$ shown in Figure 1.

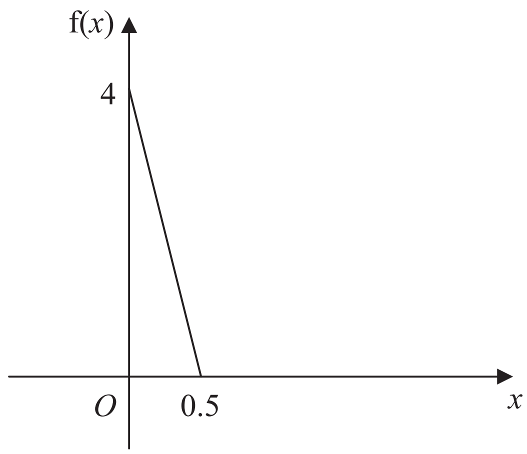


**Figure 1**

(a) Show that $\mathrm{f}(x) = 4 - 8x$ for $0 \leqslant x \leqslant 0.5$ and specify $\mathrm{f}(x)$ for all real values of $x$.
**(4)**

(b) Find the cumulative distribution function $\mathrm{F}(x)$.
**(4)**

(c) Find the median of $X$.
**(3)**

(d) Write down the mode of $X$.
**(1)**

(e) State, with a reason, the skewness of $X$.
**(1)**

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**Question 5 continued**



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**Question 5 continued**

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**Question 5 continued**

Q5

**(Total 13 marks)**





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**6.** Cars arrive at a motorway toll booth at an average rate of 150 per hour.

(a) Suggest a suitable distribution to model the number of cars arriving at the toll booth, $X$, per minute.
**(2)**

(b) State clearly any assumptions you have made by suggesting this model.
**(2)**

Using your model,

(c) find the probability that in any given minute

(i) no cars arrive,

(ii) more than 3 cars arrive.
**(3)**

(d) In any given 4 minute period, find $m$ such that $P(X > m) = 0.0487$
**(3)**

(e) Using a suitable approximation find the probability that fewer than 15 cars arrive in any given 10 minute period.
**(6)**

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**Question 6 continued**

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**Question 6 continued**

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**Question 6 continued**

Q6

**(Total 16 marks)**



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**7.** The queuing time in minutes, $X$, of a customer at a post office is modelled by the probability density function

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

(a) Show that $k = \dfrac{4}{6561}$.
**(3)**

Using integration, find

(b) the mean queuing time of a customer,
**(4)**

(c) the probability that a customer will queue for more than 5 minutes.
**(3)**

Three independent customers shop at the post office.

(d) Find the probability that at least 2 of the customers queue for more than 5 minutes.
**(3)**

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**Question 7 continued**

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**Question 7 continued**

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**Question 7 continued**

Q7

**(Total 13 marks)**

**TOTAL FOR PAPER: 75 MARKS**

**END**

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