

# GCE Examinations

## Statistics

### Module S2

Advanced Subsidiary / Advanced Level

Paper C

Time: 1 hour 30 minutes

#### *Instructions and Information*

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Candidates may use any calculator except those with a facility for symbolic algebra and/or calculus.

Full marks may be obtained for answers to ALL questions.

Mathematical and statistical formulae and tables are available.

This paper has 7 questions.

#### *Advice to Candidates*

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You must show sufficient working to make your methods clear to an examiner. Answers without working will gain no credit.



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1. (a) Explain briefly what you understand by the terms
- (i) population,
  - (ii) sample. **(2 marks)**
- (b) Giving a reason for each of your answers, state whether you would use a census or a sample survey to investigate
- (i) the dietary requirements of people attending a 4-day residential course,
  - (ii) the lifetime of a particular type of battery. **(4 marks)**
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2. The manager of a supermarket receives an average of 6 complaints per day from customers.
- Find the probability that on one day she receives
- (a) 3 complaints, **(3 marks)**
  - (b) 10 or more complaints. **(2 marks)**
- The supermarket is open on six days each week.
- (c) Find the probability that the manager receives 10 or more complaints on no more than one day in a week. **(4 marks)**
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3. The sales staff at an insurance company make house calls to prospective clients. Past records show that 30% of the people visited will take out a new policy with the company.
- On a particular day, one salesperson visits 8 people. Find the probability that, of these,
- (a) exactly 2 take out new policies, **(3 marks)**
  - (b) more than 4 take out new policies. **(2 marks)**
- The company awards a bonus to any salesperson who sells more than 50 policies in a month.
- (c) Using a suitable approximation, find the probability that a salesperson gets a bonus in a month in which he visits 150 prospective clients. **(5 marks)**
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4. A rugby player scores an average of 0.4 tries per match in which he plays.

(a) Find the probability that he scores 2 or more tries in a match. **(5 marks)**

The team's coach moves the player to a different position in the team believing he will then score more frequently. In the next five matches he scores 6 tries.

(b) Stating your hypotheses clearly, test at the 5% level of significance whether or not there is evidence of an increase in the number of tries the player scores per match as a result of playing in a different position.

**(5 marks)**

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5. The continuous random variable  $X$  has the following cumulative distribution function:

$$F(x) = \begin{cases} 0, & x < 0, \\ \frac{1}{432} x^2(x^2 - 16x + 72), & 0 \leq x \leq 6, \\ 1, & x > 6. \end{cases}$$

(a) Find  $P(X < 2)$ . **(2 marks)**

(b) Find and specify fully the probability density function  $f(x)$  of  $X$ . **(4 marks)**

(c) Show that the mode of  $X$  is 2. **(6 marks)**

(d) State, with a reason, whether the median of  $X$  is higher or lower than the mode of  $X$ .

**(1 mark)**

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*Turn over*

6. A shop receives weekly deliveries of 120 eggs from a local farm. The proportion of eggs received from the farm that are broken is 0.008
- (a) Explain why it is reasonable to use the binomial distribution to model the number of eggs that are broken in each delivery. **(3 marks)**
- (b) Use the binomial distribution to calculate the probability that at most one egg in a delivery will be broken. **(4 marks)**
- (c) State the conditions under which the binomial distribution can be approximated by the Poisson distribution. **(1 mark)**
- (d) Using the Poisson approximation to the binomial, find the probability that at most one egg in a delivery will be broken. Comment on your answer. **(5 marks)**
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7. The random variable  $X$  follows a continuous uniform distribution over the interval  $[2, 11]$ .
- (a) Write down the mean of  $X$ . **(1 mark)**
- (b) Find  $P(X \geq 8.6)$ . **(2 marks)**
- (c) Find  $P(|X - 5| < 2)$ . **(2 marks)**

The random variable  $Y$  follows a continuous uniform distribution over the interval  $[a, b]$ .

- (d) Show by integration that

$$E(Y^2) = \frac{1}{3}(b^2 + ab + a^2). \quad \mathbf{(5 \text{ marks})}$$

- (e) Hence, prove that

$$\text{Var}(Y) = \frac{1}{12}(b - a)^2.$$

You may assume that  $E(Y) = \frac{1}{2}(a + b)$ . **(4 marks)**

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**END**