GCE Examinations

Statistics
Module S2

Advanced Subsidiary / Advanced Level

Paper A

Time: 1 hour 30 minutes

Instructions and Information

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

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 golfer believes that the distance, in metres, that she hits a ball with a 5 iron, follows a continuous uniform distribution over the interval [100, 150].

(a) Find the median and interquartile range of the distance she hits a ball, that would be predicted by this model.

(3 marks)

(b) Explain why the continuous uniform distribution may not be a suitable model.

(2 marks)

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

$$\mathrm{F}(x) = \begin{cases} 0, & x < 0, \\ \frac{1}{64}(16x - x^2), & 0 \le x \le 8, \\ 1, & x > 8. \end{cases}$$

(a) Find $\mathrm{P}(X > 5)$. **(2 marks)**

(b) Find and specify fully the probability density function $\mathrm{f}(x)$ of X. **(3 marks)**

(c) Sketch $\mathrm{f}(x)$ for all values of x. **(3 marks)**

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3. An electrician records the number of repairs of different types of appliances that he makes each day. His records show that over 40 working days he repaired a total of 180 CD players.

(a) Explain why a Poisson distribution may be suitable for modelling the number of CD players he repairs each day and find the parameter for this distribution.

(4 marks)

(b) Find the probability that on one particular day he repairs

(i) no CD players,

(ii) more than 6 CD players. **(3 marks)**

(c) Find the probability that over 10 working days he will repair more than 6 CD players on exactly 3 of the days.

(3 marks)

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4. A teacher wants to investigate the sports played by students at her school in their free time. She decides to ask a random sample of 120 pupils to complete a short questionnaire.

(a) Give two reasons why the teacher might choose to use a sample survey rather than a census.

(2 marks)

(b) Suggest a suitable sampling frame that she could use. **(1 mark)**

The teacher believes that 1 in 20 of the students play tennis in their free time. She uses the data collected from her sample to test if the proportion is different from this.

(c) Using a suitable approximation and stating the hypotheses that she should use, find the critical region for this test. The probability for each tail of the region should be as close as possible to 5%.

(6 marks)

(d) State the significance level of this test. **(1 mark)**

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5. As part of a business studies project, 8 groups of students are each randomly allocated 10 different shares from a listing of over 300 share prices in a newspaper. Each group has to follow the changes in the price of their shares over a 3-month period.

At the end of the 3 months, 35% of all the shares in the listing have increased in price and the rest have decreased.

(a) Find the probability that, for the 10 shares of one group,

(i) exactly 6 have gone up in price,

(ii) more than 5 have gone down in price. **(5 marks)**

(b) Using a suitable approximation, find the probability that of the 80 shares allocated in total to the groups, more than 55 will have decreased in value.

(6 marks)

Turn over

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6. A shoe shop sells on average 4 pairs of shoes per hour on a weekday morning.

(a) Suggest a suitable distribution for modelling the number of sales made per hour on a weekday morning and state the value of any parameters needed.

(1 mark)

(b) Explain why this model might have to be modified for modelling the number of sales made per hour on a Saturday morning.

(1 mark)

(c) Find the probability that on a weekday morning the shop sells

(i) more than 4 pairs in a one-hour period,

(ii) no pairs in a half-hour period,

(iii) more than 4 pairs during each hour from 9 am until noon. **(6 marks)**

The area manager visits the shop on a weekday morning, the day after an advert appears in a local paper. In a one-hour period the shop sells 7 pairs of shoes, leading the manager to believe that the advert has increased the shop's sales.

(d) Stating your hypotheses clearly, test at the 5% level of significance whether or not there is evidence of an increase in sales following the appearance of the advert.

(4 marks)

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7. The continuous random variable T has the following probability density function:

$$\mathrm{f}(t) = \begin{cases} k(t^2 + 2), & 0 \leq t \leq 3, \\ 0, & \text{otherwise.} \end{cases}$$

(a) Show that $k = \frac{1}{15}$. **(4 marks)**

(b) Sketch $\mathrm{f}(t)$ for all values of t. **(3 marks)**

(c) State the mode of T. **(1 mark)**

(d) Find $\mathrm{E}(T)$. **(5 marks)**

(e) Show that the standard deviation of T is 0.798 correct to 3 significant figures.

(6 marks)

END

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