GCE Examinations

Statistics
Module S1

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 6 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. An athlete believes that her times for running 200 metres in races are normally distributed with a mean of 22.8 seconds.

(a) Given that her time is over 23.3 seconds in 20% of her races, calculate the variance of her times.

(5 marks)

(b) The record over this distance for women at her club is 21.82 seconds. According to her model, what is the chance that she will beat this record in her next race?

(3 marks)

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2. The events A and B are such that

$$\mathrm{P}(A) = \tfrac{5}{16},\ \mathrm{P}(B) = \tfrac{1}{2} \text{ and } \mathrm{P}(A \mid B) = \tfrac{1}{4}$$

Find

(a) $\mathrm{P}(A \cap B)$, **(2 marks)**

(b) $\mathrm{P}(B' \mid A)$, **(3 marks)**

(c) $\mathrm{P}(A' \cup B)$, **(2 marks)**

(d) Determine, with a reason, whether or not the events A and B are independent.

(3 marks)

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3. A group of 60 children were each asked to choose an integer value between 1 and 9 inclusive. Their choices are summarised in the table below.

Value chosen	1	2	3	4	5	6	7	8	9
Number of children	3	4	5	10	12	13	7	4	2

(a) Calculate the mean and standard deviation of the values chosen. **(6 marks)**

It is suggested that the value chosen could be modelled by a discrete uniform distribution.

(b) Write down the mean that this model would predict. **(2 marks)**

Given also that the standard deviation according to this model would be 2.58,

(c) explain why this model is not suitable and suggest why this is the case. **(2 marks)**

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4. A six-sided die is biased such that there is an equal chance of scoring each of the numbers from 1 to 5 but a score of 6 is three times more likely than each of the other numbers.

(a) Write down the probability distribution for the random variable, X, the score on a single throw of the die. **(4 marks)**

(b) Show that $E(X) = \frac{33}{8}$. **(3 marks)**

(c) Find $E(4X - 1)$. **(2 marks)**

(d) Find $\text{Var}(X)$. **(4 marks)**

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5. The number of patients attending a hospital trauma clinic each day was recorded over several months, giving the data in the table below.

Number of patients	10 - 19	20 - 29	30 - 34	35 - 39	40 - 44	45 - 49	50 - 69
Frequency	2	18	24	30	27	14	5

These data are represented by a histogram.

Given that the bar representing the 20 - 29 group is 2 cm wide and 7.2 cm high,

(a) calculate the dimensions of the bars representing the groups

(i) 30 - 34

(ii) 50 - 69 **(6 marks)**

(b) Use linear interpolation to estimate the median and quartiles of these data. **(6 marks)**

The lowest and highest numbers of patients recorded were 14 and 67 respectively.

(c) Represent these data with a boxplot drawn on graph paper and describe the skewness of the distribution. **(5 marks)**

Turn over

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6. *Penshop* have stores selling stationary in each of 6 towns. The population, P, in tens of thousands and the monthly turnover, T, in thousands of pounds for each of the shops are as recorded below.

Town	Abberton	Bember	Claster	Deller	Edgeton	Figland
P (0 000's)	3.2	7.6	5.2	9.0	8.1	4.8
T (£ 000's)	11.1	12.4	13.3	19.3	17.9	11.8

(a) Represent these data on a scatter diagram with T on the verical axis. **(4 marks)**

(b) (i) Which town's shop might appear to be underachieving given the populations of the towns?

(ii) Suggest two other factors that might affect each shop's turnover. **(3 marks)**

You may assume that

$$\Sigma P = 37.9, \quad \Sigma T = 85.8, \quad \Sigma P^2 = 264.69, \quad \Sigma T^2 = 1286, \quad \Sigma PT = 574.25.$$

(c) Find the equation of the regression line of T on P. **(7 marks)**

(d) Estimate the monthly turnover that might be expected if a shop were opened in Gratton, a town with a population of 68 000.

(2 marks)

(e) Why might the management of *Penshop* be reluctant to use the regression line to estimate the monthly turnover they could expect if a shop were opened in Haggin, a town with a population of 172 000?

(1 mark)

END

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