GCE Examinations

Statistics
Module S1

Advanced Subsidiary / Advanced Level

Paper B

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. An adult evening class has 14 students. The ages of these students have a mean of 31.2 years and a standard deviation of 7.4 years.

A new student who is exactly 42 years old joins the class. Calculate the mean and standard deviation of the 15 students now in the group.

(7 marks)

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2. A tennis coach believes that taller players are generally capable of hitting faster serves. To investigate this hypothesis he collects data on the 20 adult male players he coaches.

The height, h, in metres and the speed of each player's fastest serve, v, in miles per hour were recorded and summarised as follows:

$$\Sigma h = 36.22, \quad \Sigma v = 2275, \quad \Sigma h^2 = 65.7396, \quad \Sigma v^2 = 259853, \quad \Sigma hv = 4128.03.$$

(a) Calculate the product moment correlation coefficient for these data. **(5 marks)**

(b) Comment on the coach's hypothesis. **(2 marks)**

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3. The events A and B are such that

$$\mathrm{P}(A) = 0.2 \text{ and } \mathrm{P}(A \cup B) = 0.6$$

Find

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

(b) $\mathrm{P}(A' \cap B)$. **(2 marks)**

Given also that events A and B are independent, find

(c) $\mathrm{P}(B)$, **(4 marks)**

(d) $\mathrm{P}(A' \cup B')$. **(2 marks)**

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4. The discrete random variable X has the following probability distribution.

x	1	2	3	4	5
$P(X = x)$	0.1	0.35	k	0.15	k

Calculate

(a) k, **(2 marks)**

(b) $F(2)$, **(1 mark)**

(c) $P(1.3 < X \leq 3.8)$, **(2 marks)**

(d) $E(X)$, **(2 marks)**

(e) $\text{Var}(3X + 2)$. **(5 marks)**

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5. For a project, a student asked 40 people to draw two straight lines with what they thought was an angle of 75° between them, using just a ruler and a pencil. She then measured the size of the angles that had been drawn and her data are summarised in this stem and leaf diagram.

Angle	(6 | 4 means 64°)	Totals
4	1	(1)
4		(0)
5	0 2 4	(3)
5	5 8 9	(3)
6	1 1 3 3 4	(5)
6	5 5 7 8 9	(5)
7	0 1 1 2 3 3 4 4 4	(9)
7	5 6 6 7 7 9 9	(7)
8	0 1 1 3 4	(5)
8	5 6	(2)

(a) Find the median and quartiles of these data. **(4 marks)**

Given that any values outside of the limits $Q_1 - 1.5(Q_3 - Q_1)$ and $Q_3 + 1.5(Q_3 - Q_1)$ are to be regarded as outliers,

(b) determine if there are any outliers in these data, **(3 marks)**

(c) draw a box plot representing these data on graph paper, **(3 marks)**

(d) describe the skewness of the distribution and suggest a reason for it. **(2 marks)**

Turn over

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6. The individual letters of the word STATISTICAL are written on 11 cards which are then shuffled.

One card is selected at random. Find the probability that it is

(a) a vowel, **(1 mark)**

(b) a T, given that it is a consonant. **(2 marks)**

The 11 cards are then shuffled again and the top three are turned over. Find the probability that

(c) all three of the cards have a T on them, **(3 marks)**

(d) at least two of the cards show a vowel. **(6 marks)**

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7. The volume of liquid in bottles of sparkling water from one producer is believed to be normally distributed with a mean of 704 ml and a variance of 3.2 ml^2.

Calculate the probability that a randomly chosen bottle from this producer contains

(a) more than 706 ml, **(3 marks)**

(b) between 703 and 708 ml. **(4 marks)**

The bottles are labelled as containing 700 ml.

(c) In a delivery of 1 200 bottles, how many could be expected to contain less than the stated 700 ml?

(4 marks)

The bottling process can be adjusted so that the mean changes but the variance is unchanged.

(d) What should the mean be changed to in order to have only a 0.1% chance of a bottle having less than 700 ml of sparkling water? Give your answer correct to 1 decimal place.

(4 marks)

END

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